



**NEO APPROACH
IS REVAMPED A330
REAL RIVAL TO 787
OR JUST OLD IDEA?
TWINS TUSSELE P40**

VIPERS CLEARED

US government approves sale of 15 Bell AH-1Zs to Pakistan in package with 1,000 Hellfire missiles **23**

SAVING THE SPN

Owner of rights to former Grob light twinjet looks to resurrect programme after seven years **27**

FLIGHT

INTERNATIONAL

From  Flightglobal

14-20 APRIL 2015



MRO SPECIAL

DATA IS POWER

How supercomputing could transform the way P&W engines are monitored and maintained

£3.50



AN ICON JUST GOT LARGER



THE NEW NAVITIMER 46 mm



Pratt & Whitney

COVER IMAGE

Pratt & Whitney's PW1524G geared turbofan engine for the Bombardier CSeries undergoes ground testing at the company's West Palm Beach site **P37**



BEHIND THE HEADLINES

Stephen Trimble managed a visit to Moscow's Red Square during a trip to meet Russian aerospace leaders for a package to be published before August's **MAKS** air show. His story on Ilyushin Finance and the **CSeries** is on P9



NEXT WEEK TURKEY

Our country special will include features on Turkey's defence manufacturing and growing airline sector

NEWS

THIS WEEK

- 8** Croatia weighs up its fighter options. Rosavia wraps up Ecojet tests
- 9** IFC begins to lose interest in CSeries. EASA eases route to performance-based navigation
- 10** Tyler criticises Germanwings inquiry
- 12** Blue Origin poised for capsule tests. Boeing misses first-quarter delivery target

AIR TRANSPORT

- 14** Icing caused Swiftair stall. EASA advises e-cigs ban for hold baggage. PurePower all geared up for P&W's horizontal production line
- 16** Nothing amiss ahead of MD-88 crash. Plea to FAA to outlaw United's 'gag order' on aircrew
- 18** China Airlines eyes 50 jets. Alitalia loses out on home turf to surging Ryanair
- 21** Warning on outdated GPWS. Darwin evolution clears Etihad for deal. Tax treaty boost for Hong Kong's leasing market

DEFENCE

- 22** RSAF gets up to speed with Elbit Hermes 450 UAV fleet. US Army brings back Apache's Stinger potential. Warsaw wants to arm Watchkeepers
- 23** DSCA approves the sale of 15 AH-1Z Vipers to Pakistan. DARPA research project seeks to speed up integration of technology. USA reveals plan to buy 477 F-135s
- 23** Pseudo satellite warms up for market

BUSINESS AVIATION

- 27** SPn founder talks up light jet's return. Single-engined IFR ruling nears. NetJets gets Embraer's 100th US-built Phenom

NEWS FOCUS

- 28** Composite MRO... without the stress



Bell Helicopter

Sale of 15 AH-1Z Vipers approved for Pakistan **P23**

COVER STORY

- 37 Big data dawning** Supercomputing could transform how P&W engines are monitored and maintained, with information streamed in petabytes and slashing staffing hours

FEATURES

- 30 MRO NORTH AMERICA Right tools for the job** Are the region's MRO providers ready to respond to the challenge of industry innovation?
- 40 WIDEBODIES Mid-twin tussle** Airbus is taking the fight to Boeing with its A330neo. But could Toulouse's re-engined family be too little, too late?
- 44 MARKET OVERVIEW Is China feeling the chill?** The business jet sector of the world's second-largest economy may be slowing down, but manufacturers are optimistic about the longer term

REGULARS

- 7 Comment**
- 46 Letters**
- 48 Classified**
- 51 Jobs**
- 55 Working Week**



CSeries fortunes in the balance **P9**. Big airframers vie for top spot in medium-sized widebody market **P40**



Bombardier/Airbus

Download the new Commercial Engines Report
now updated with enhanced data and in-depth market analysis

flightglobal.com/commengines



IMAGE OF THE WEEK

King Philippe of Belgium visited Beauvechain air base on 1 April, and while there he co-piloted the NH Industries NH90 tactical transport helicopter (TTH) based with the 1st wing. Belgium has received all four of its TTH variants and has four of the NATO Frigate Helicopter variant of the NH90 on order

View more great aviation shots online and in our weekly tablet edition:



flightglobal.com/
flight-international



Rex Features

THE WEEK IN NUMBERS

↓ **40%**

Flightglobal dashboard

The amount by which French authority DGCA asked airlines to cut capacity in response to an air traffic control strike

\$5.6bn

Alcoa

The pro-forma value of Alcoa's 2014 aerospace revenues, with its forthcoming acquisition of RTI International Metals

↑ **29,735**

Flightglobal

The number of seats on the 59 A380s now flying with Emirates, according to Flightglobal data

QUESTION OF THE WEEK

Last week, we asked: **As the US Army struggles to fund helicopter projects, it should:** You said:

43%

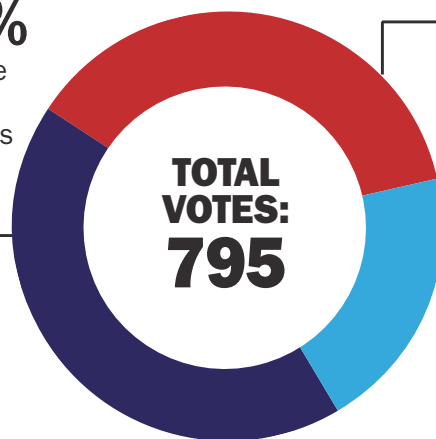
Prioritise current upgrades

38%

Concentrate on future needs

19%

Get more money from Congress



This week, we ask: **What will Croatia replace its MiG-21s with?**

☐ Saab Gripen ☐ Lockheed Martin F-16

☐ Dassault Mirage 2000 ☐ Other

Vote at flightglobal.com



dashboard

Flightglobal's premium news and data service delivers breaking air transport stories with profiles, schedules, and fleet, financial and traffic information flightglobal.com/dashboard

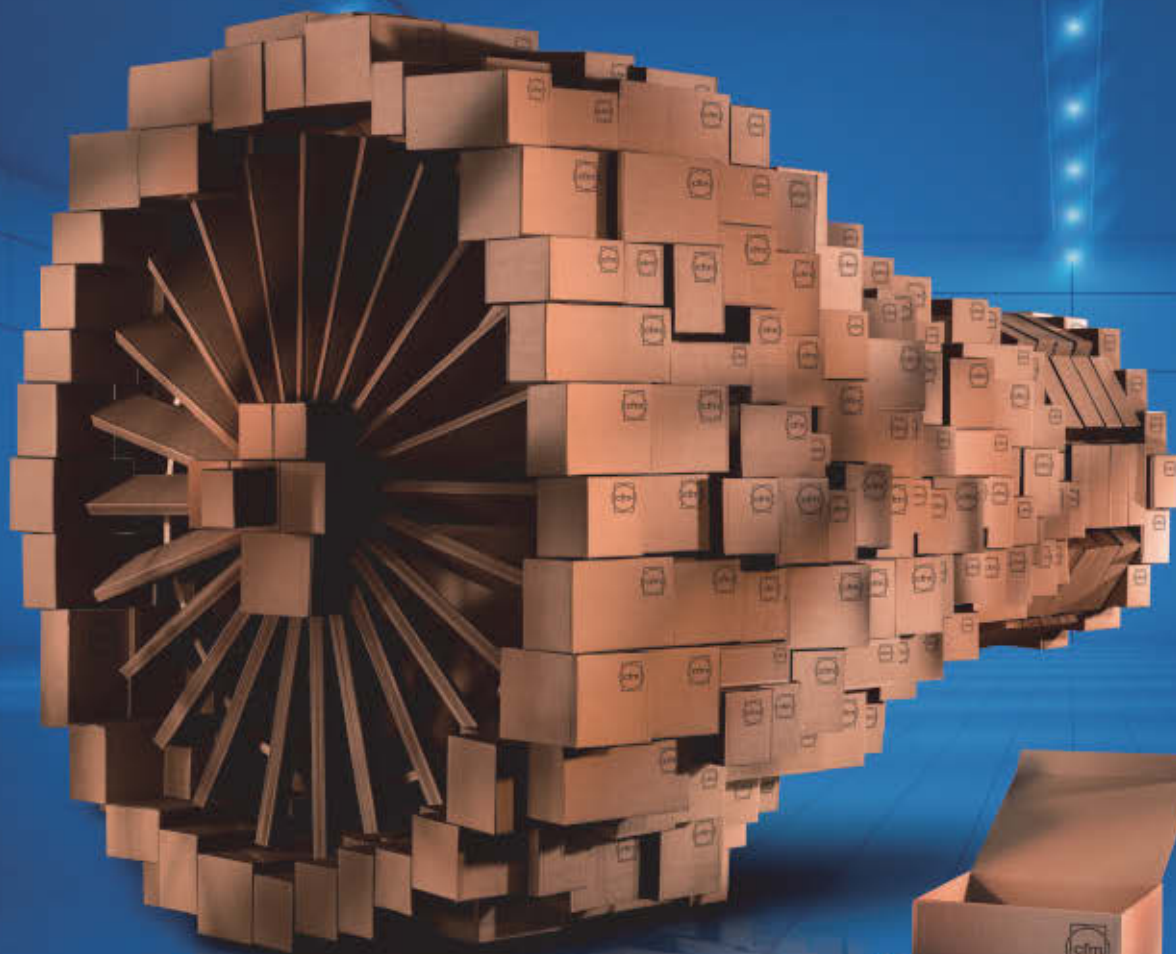


CAE offers training centres, training services, and simulation products for trainer and fighter aircraft.

Download the Military Simulator Census online now.

www.flightglobal.com/milisim





TRUEngine.TM Protect your asset. Think outside the box

Optimum performance isn't just about individual parts. It's about the entire engine system. TRUEngine qualification is available for CFM engines maintained to our precise standards. This assures expedited technical support, unmatched product knowledge and peace of mind. With as much as 50% higher residual value*, it's easy to see how our TRUEngine program helps to protect your overall investment.

Take part now at cfmaeroengines.com/truengine

*Based on CFM, GE and independent third-party research.
CFM International is a 50/50 joint company between Snecma (Safran) and GE.

Unmatched Experience | World-Class Support | Exceptional Value

When something new arrives, we make sure it departs.



We welcome the new A350.

Our extensive, flexible portfolio of MRO products covers the A350's entire life cycle, focusing in particular on the management of its IT systems, since in the future aircraft and their maintenance systems will be more strongly networked than ever before. That's how we'll ensure that right from the first delivery, our customers' A350s are always flying.

Lufthansa Technik AG, marketing.sales@lht.dlh.de
Call us: +49-40-5070-5553



www.lufthansa-technik.com/a350



Lufthansa Technik
More mobility for the world

Still in the game

With more bad news for Bombardier from one of its biggest CSeries customers, its new boss must install a team who can deliver the aircraft hitch free and compete much harder for sales

The problems mount at Bombardier. Every promising piece of news – entry into flight testing of the CS300 in February – is outweighed by the bad: rumours of a further delay to CS100 first delivery, and now an admission by third-largest customer, Ilyushin Finance, that it is re-evaluating its commitment to the CSeries.

The company – controlled still by the family that transformed it from snowmobile maker to global aerospace and rail transportation combine – is at least not in denial, having brought in industry heavyweight Alain Bellemare to replace a Beaudoin, and with a clear mandate to take firm and decisive action.

The former UTC executive's broom has begun to sweep, with the latest high-profile exit that of commercial aircraft head Mike Arcamone. Bellemare is determined to bring in new talent with fresh perspectives after a five-year spell in which Bombardier has failed to gain market traction with its flagship programme.

Though up to its neck in debt, Bombardier has got cash to get the CSeries into service

Ilyushin Finance chief Alexander Rubtsov could, of course, be taking advantage of Bombardier's stricken position to improve his bargaining leverage, given the worsening economic circumstances in Russia where he will be hoping to place most of his aircraft.

However, the Canadian firm can ill afford to lose one of its four big customers. Macquarie, Republic Airways, Ilyushin Finance and Lufthansa account for more than half of total CSeries orders. It seems unlikely that – even with a debut at June's Paris air show –



Fresh management blood may not be enough

other blue-chip operators are waiting in the wings.

For Bombardier to restore confidence, it must do three things. Above all, it has to keep flight testing on track. Second, it should urgently agree terms with a launch customer. It takes months to prepare an airline to introduce a new aircraft into service and Bombardier is losing valuable time. Third, it must find a way to sell the CSeries to new buyers. If Bombardier's four largest customers are becoming restless, it will not be enough to simply convert options to keep production on pace.

Bellemare's job remains the toughest in aerospace, but the markets have not abandoned Bombardier yet. Moody's has just raised its liquidity rating, based on the fact that, though up to its neck in debt, Bombardier has at least got cash to get the CSeries to certification.

That done, it is a matter of convincing airlines that this is an aircraft that can do a job for them, and ensuring a smooth entry into service. While that would not solve all Bombardier's woes, making a success of the CSeries would at least allow Bellemare and his team to focus on the bigger picture. ■

See This Week P9

The paradox of supply and demand

As sales increase, prices fall. That is the first rule of economics – but when neither prices nor volume can move, it is also a frustrating paradox for any salesman, who may wonder: how do I improve sales if I can't reduce the price until I improve the sales?

Commercial aviation can employ useful accounting policies, such as amortising capital spending over a block of production. Governments do not have the luxury of commercial accounting policies, so prices are set the old-fashioned way: work out the cost and add a small fee for the supplier's profit, or force the supplier to make a profit at a specified price.

This is Lockheed Martin's F-35 Lightning II dilemma. Sales must rise to reduce the price of the stealth

fighter, but some customers – particularly in cash-strapped Europe, but also in the USA – don't want to buy until the flyaway price is more reasonable.

The joint programme office's solution is a multi-year "block buy", to lock in higher and more consistent volume and thus help suppliers cut prices. But the US military is prohibited from seeking such deals until full-rate production begins – so the joint programme office wants Congress to authorise an exception, for three years and up to 477 aircraft.

That will do nothing to solve the F-35's technical and scheduling woes, but it could help address its affordability problem. ■

See Defence P23



Register or log in to read Murdo Morrison's recent dispatch from Bombardier's plant at Mirabel as the CS300 took flight
flightglobal.com/cseries



BRIEFING

ARCAMONE OUT AS BOMBARDIER 'SEEKS TALENT'

MANAGEMENT Another management shake-up at Bombardier aerospace has seen the departure of commercial aircraft head Mike Arcamone in favour of former International Lease Finance (ILFC) president Fred Cromer, with another ex-ILFC heavyweight, Henri Courpron, brought onboard as a strategic advisor. Alain Bellemare, who took over as corporate chief executive at the Canadian firm in February from Bombardier family scion Pierre Beaudoin, says he is "bringing in new talent to reinforce the company's management team [and] instill a fresh perspective". In August 2014 a sweeping reorganisation saw the departure of aerospace division head Guy Hachey and then, under Arcamone, an overhaul of the sales organisation culminating in the January 2015 departure of chief salesman Ray Jones.

UK AIRSHIP DEVELOPER SECURES EU GRANT

FUNDING As part of its campaign to raise funds to bring its Airlander 10 airship to flight, the UK's Hybrid Air Vehicles has received a €2.5 million (\$2.7 million) European Union grant through the Smart, Green and Integrated Transport Societal Challenge fund.

SAS PUTS NEW CABINS ON GOOGLE STREET VIEW

INTERIORS SAS is showcasing its refurbished Airbus A330 and A340 widebodies by offering virtual cabin tours via Google Street View. Visitors to the Scandinavian group's website can pass through the economy, premium economy and business-class sections using Street View's standard navigational interface, which allows views from multiple angles and with adjustable levels of magnification.

EFFORTS CONTINUE TO REOPEN HALIFAX RUNWAY

ACCIDENT Workers at Halifax Stanfield International airport have been making progress towards opening the main runway, closed to traffic following the crash of an Air Canada Airbus A320 on 29 March. The airport said in a 7 April update it had completed an environmental assessment, and crews were assessing damage to the edge lights and repairing approach lights and localiser antenna.

FIRST OF TRIO OF A330-200S ARRIVES AT AIR ALGERIE

FLEET Air Algerie has taken delivery of the first of three Airbus A330-200s ordered by the carrier last year as part of a fleet modernisation. The airline, which already operates General Electric-powered A330s, is taking the aircraft with a new cabin interior. It features a "completely redesigned" layout, says the airframer, with 18 business class, 14 premium economy and 219 economy seats.

STRESS WEAKNESS BEHIND 737 MAIN GEAR FAILURE

SAFETY UK investigators have traced the main gear failure on a landing Boeing 737-400SF at East Midlands to stress corrosion cracking and fatigue. The fatigue weakened the left main gear about 75mm above the axle of the Air Contractors aircraft, says the Air Accidents Investigation Branch. It had been arriving at East Midlands from Paris, with 10t of freight, on 29 April last year.

COMLUX BEGINS WORK ON US HANGAR EXTENSION

BUSINESS AVIATION Comlux America, the US completions arm of Comlux Group, has broken ground on an extension to its VIP completion hangar. The new construction is expected to be completed in six months, and will raise the footprint to 14,600m² (160,000ft²) – large enough to accommodate one widebody and four narrowbody aircraft.



The NATO member currently has a fleet of seven MiG-21s

PROGRAMME IGOR SALINGER BELGRADE

Croatia weighs up its fighter options

Zagreb is understood to be looking at three candidates to replace its ageing MiG-21s, with decision due late this year

Croatia has confirmed it will retain a combat fixed-wing fleet, and will restart a programme to replace its ageing Mikoyan MiG-21 bisD/UMD aircraft.

The state defence council – chaired by President Kolinda Grabar-Kitarović – confirmed the decision, and the ministry of defence is believed to be "evaluating three options" to replace its 12-strong MiG-21 fleet.

By the end of the year a commission comprising members from the MoD, Croatian air force, ministry of finance and commerce and parliamentary parties will announce its choice, and the decision will be finalised in 2016.

Sources in Croatia claim only western aircraft are under consideration, either new or refurbished,

with speculation that the Saab Gripen and Lockheed Martin F-16s are favourites.

However, depending on budgets, the Dassault Mirage 2000, Israel Aerospace Industries Kfir and a variant of the Korea Aerospace Industries T-50 are all thought to also be candidates.

Funding is the main drawback, so the NATO "Smart Defence" model that encourages member states to pool assets – as the Czech Republic and Hungary did with their Gripen leases – is being considered.

The USA could donate used older models of the F-16 that could be modernised – but ex-Royal Netherlands Air Force or Belgian air force aircraft may offer other options. ■

DEVELOPMENT TOM ZAITZEV MOSCOW

Rosavia wraps up Ecojet tests

Russian consortium Rosavia has completed aerodynamic tests to validate a mock-up of its Frigate Ecojet widebody airliner.

A nine-month testing campaign began in July 2014 at the European Transonic Windtunnel in Cologne, Germany.

Project deputy director Alexander Klimov says the Frigate Ecojet's elliptical fuselage called for longer-than-usual validation trials and innovative techniques.

"This involved manufacturing a heat-insulated airtight contour filled with liquid boiling nitro-

gen," he says. "To make the mock-up, we used cold-resistant steel with a higher structural limit enabling it to preserve properties in cryogenic temperatures."

The Frigate Ecojet now proceeds to static trials in which an actual-size 14m-long fuselage section will be used to validate the shape's resistance to pressurisation forces.

Klimov says trials will take place at a testing facility run by German specialist IMA Dresden and are scheduled to begin in June or July. ■



Tyler criticises
Germanwings
inquiry
THIS WEEK P10

THIS WEEK

ORDER STEPHEN TRIMBLE MOSCOW

IFC begins to lose interest in CSeries

Bombardier's breakthrough into Russian market in doubt as lessor and third biggest customer feels impact of sanctions

Repeated delays and a new financing problem could drive Bombardier's third-largest customer for the CSeries to cancel the order within a few months.

Moscow-based lessor Ilyushin Finance Corporation (IFC) has decided to "re-evaluate all our options regarding our participation in this programme," director general Alexander Rubtsov says.

The review marks a change in enthusiasm by the Russian lessor since signing the order for 32 CS300s in February 2014.

IFC is partly-owned by Russian aircraft manufacturing conglomerate United Aircraft Corporation. Its charter calls on the lessor to help launch and buy locally-built aircraft.

The deal signed 15 months ago bolstered the slow-selling CSeries orderbook and offered the Canadian manufacturer a key opportunity to break into the Russian market. Bombardier says IFC remains a "solid, valued customer".

"It's our understanding that the CSeries aircraft makes up an important component of IFC's expansion plans and we are therefore confident we can work together to overcome any concerns," the airframer says.

But Rubtsov says he has grown impatient waiting for the CSeries to be delivered. The cost of the deal also grew after the Canadian government banned Russian companies from access to export bank financing with lower inter-



Ilyushin Finance has become impatient waiting for the 32 CS300s it ordered

est rates, he says. The ban was imposed as part of Canada's response to the conflict in Ukraine.

IFC now plans to decide whether to cancel, amend or proceed with the CSeries order at the Paris air show, which begins on 15 June, Rubtsov says.

CONCERNS

IFC's decision will not be linked to any concerns about the aircraft's performance. Rubtsov recently returned from a quarterly meeting with Bombardier in Montreal, and, he says, the performance of the CS100 flight test aircraft is "quite spectacular". With the exception of a small weight increase, the CS100 is meeting

Bombardier's promises for fuel efficiency and range, he says.

In addition to the financing problem, however, IFC is concerned Bombardier will announce another schedule delay, Rubtsov says. The CS100 was originally expected to enter service in late 2013, with the stretched CS300 following six months later.

The aircraft is now scheduled to be certificated in the second half of 2015. It was also supposed to enter service by the end of the year, but newly-appointed Bombardier chief executive Alain Bellemare recently said that entry into service could slip into 2016.

IFC is also weighing the CSeries requirement against new pressure from the Russian government to support the Sukhoi Superjet. Moscow has recently committed to invest 100 billion roubles (\$1.86 billion) to recapitalise the programme. If consummated, part of the money could be directed to IFC to buy another tranche of Superjets, and that could come at the expense of the CSeries.

Bombardier has 243 firm orders for the CSeries – 57 short of its goal to have 300 aircraft on backlog by entry into service. IFC's order for 32 aircraft is exceeded only by the 40 aircraft each under contract by Republic Airways and Macquarie Finance. ■

REGULATIONS DAVID LEARMOUNT LONDON

EASA eases route to performance-based navigation

European operators can expect a less bureaucratic transition to performance-based navigation (PBN) procedures after EASA revealed plans to simplify the preparation and approval process.

EASA has published an opinion (3/2015) containing proposals for "amendments to PBN-related safety rules", which will become

European Commission rules when the process is complete. The opinion, EASA says, "marks a significant change in the way PBN operations are regulated".

Based on a risk assessment, EASA says most PBN operations are considered to be a normal navigation mode for commercial as well as non-commercial air op-

erators, and that this needs to be adequately reflected in the regulatory framework.

The agency says: "The new regulatory approach is relying on improved pilot training and checking as well as on effective and performance-based operational rules. The proposed proportionate rules are in particular

beneficial for GA operators, which will see a significant reduction in administrative tasks."

This is part of a general move by EASA towards performance-based regulation, meaning that the emphasis is on the required performance standard or outcome rather than the means by which it is achieved. ■



INVESTIGATION GHIM-LAY YEO WASHINGTON DC

Tyler criticises Germanwings inquiry

Airline association boss says 'highly public' investigation into Alpine crash departs from established industry practice

IATA director general Tony Tyler has added his voice to calls for aircraft accident investigations to be conducted in a "non-punitive" manner, in the aftermath of the Germanwings Airbus A320 crash.

The process has been "highly unusual", Tyler told reporters at an IATA event in Washington, DC. "It was a highly public criminal investigation," he said, noting that the aviation industry has

long-established procedures related to investigating incidents.

IATA is not the only organisation that has expressed reservations about the investigation into the Germanwings crash. Pilot associations have taken issue with the release of information from the investigation by French prosecutors, who have so far pinned the cause of the 24 March crash on deliberate action by the co-pilot.

"The first thing we have to make sure is that the accident is properly investigated," says Tyler. "We learn what happened and we draw conclusions about what needs to be done."

Asked if IATA believes French investigation authority BEA had mishandled the investigation, Tyler says: "No, I'm not going to say anyone has done anything wrong. But the important principle to bear in mind is that accident investigations should be conducted on a non-punitive basis."

"When you have the possibility of punitive measures resulting from an accident investigation, you start to introduce unhelpful dynamics into the whole process," adds Tyler, saying that investigations then risk losing transparency and openness.

Several authorities and airlines have reacted to the

Germanwings crash by requiring two crew members to be on the flightdeck at all times. "It seems like a sensible thing to do as we consider what else needs to be done," says Tyler.

The flight data recorder recovered from the 24 March crash shows the co-pilot on several occasions increased the speed of the aircraft during descent, according to BEA. The agency, which is reviewing the FDR, adds that the co-pilot also set the autopilot to descend the aircraft to an altitude of 100ft.

Work continues to determine the specific factual progress of the flight, says the BEA.

The aircraft, operating flight 9525 from Barcelona to Dusseldorf, began a steep descent shortly after reaching cruising altitude and then crashed into high terrain, killing 150 passengers and crew. ■

DISPUTE GHIM-LAY YEO WASHINGTON DC

IATA veers clear of US-Gulf turbulence

IATA has refused to be drawn into the battle between US mainline carriers and their Gulf rivals, months before the airlines are slated to come together at the association's annual general meeting.

"We ourselves don't have a position on that," says IATA director general Tony Tyler. "IATA is the place where airlines get together on important issues and help develop global standards... it is not a place where airlines come to further or air their aeropolitical differences."

IATA's position is not surprising, given that all three US mainline carriers – United Airlines, Delta Air Lines and American Airlines – and the three Gulf carriers, Emirates Airline, Etihad Airways and Qatar Airways, are all IATA members.

The US airlines are accusing the Gulf carriers of receiving more than \$42 billion in subsidies from their

governments, and are calling on US authorities to take action under existing open skies agreements with Qatar and the United Arab Emirates.

The controversy is expected to be discussed again later this month when Qatar Airways chief executive Akbar Al Baker visits Washington DC, where he is expected to address the issue at a press conference. Al Baker's visit follows similar trips by Emirates president Tim Clark and Etihad chief executive James Hogan in March, when they met with US government officials to refute the US airlines' allegations.

IATA will hold its AGM in Miami in early June, when the open skies row could dominate the agenda. Some IATA members have taken sides in the debate, with JetBlue and FedEx siding with the Gulf carriers while Lufthansa has come out in support of the US big three. ■



Work is ongoing to determine the facts of the 24 March incident



FAMILIARISATION

Finnair maps out plan to bed-in A350

Finnair has detailed the destinations for its Airbus A350 familiarisation flights before the carrier launches long-haul services with the type to Shanghai on 25 October. It will use the A350-900 to serve the Finnish cities of Rovaniemi and Oulu on 5 October. Finnair has listed another 16 European cities to which it will operate the A350 between 6-18 October. Finnair says the A350 will replace the short-haul types used on these routes, on specific dates, to allow crews to become familiar with the aircraft. It intends to begin long-haul operations on 25 October, starting with daily flights to Shanghai before deploying the A350 on services to Beijing.



Introducing Boeing Fuel-Efficiency Solutions.

When the cost of fuel represents up to 40% of an airline's operating cost, every advantage makes a difference to the bottom line. That's why Boeing is introducing a suite of fuel-efficiency solutions to optimize fleet performance. The Boeing Fuel Dashboard tracks fuel use during every phase of flight while the Boeing Emissions Reporter captures critical emissions data. Together, they give airlines the edge only Boeing can deliver. We are standing by to answer all inquiries. E-mail us at theboeingedge@boeing.com.

www.boeing.com/commercial/boeing-edge

BOEING **EDGE**
Flight Services

SPACEFLIGHT DAN THISDELL LONDON

Blue Origin poised for capsule tests

Acceptance of reusable main engine opens path to 2015 trials of vertically launched human-rated suborbital spacecraft

US rocket developer Blue Origin is preparing to start test flights “later this year” of a human-rated suborbital spacecraft following completion of acceptance tests of a reusable engine for vertical launches.

The BE-3 engine is billed as reusable, restartable and, critically, de-throttleable – enabling vertical landings. Blue Origin president Rob Meyerson says that 30,000 seconds of firings over 450 tests has raised the confidence to begin test flights, including of the company’s New Shepard capsule.

Built at Blue Origin’s head office in Kent, Washington, and tested at its West Texas launch facility, Meyerson says the BE-3 is the first new hydrogen engine to be developed in the USA in a decade. It is capable of being throttled between 110,000lb-thrust (490kN) and 20,000lb-thrust.



Two BE-4s may be an alternative to the Atlas V’s RD-180

The powerplant is a precursor to the more powerful BE-4, being developed in partnership with United Launch Alliance and due for test firings in 2016 and flight in 2019. Two of the 550,000lb-thrust, liquid oxygen/liquefied natural gas BE-4 engines will provide

thrust equal to the RD-180 first stage engine that powers ULA’s Atlas V. Atlas V is a workhorse launcher for US security and scientific missions, but its RD-180 is ultimately sourced from Russia, which is cutting off exports in response to US and European sanc-

tions imposed over the Ukrainian diplomatic standoff.

Russia’s 2014 move to end RD-180 exports will not leave ULA short of engines in the short term, but it did spur the US Air Force to call for development of an all-US launch system. Orbital ATK has declared its intention to propose an alternative, and SpaceX has in any case sued the US government for access, with its Falcon 9 rockets, to national security launches that are operated by ULA as a monopoly. Separately, ULA was due on 13 April to announce details of its next generation launch system.

Meyerson adds that the goal is to see the engine and capsule system reusable to survive “dozens if not hundreds” of flights, with the first-stage engines landing vertically under power at the launch site, and capsules landing by parachute in the West Texas desert. ■



PROGRAMME

HondaJet prepares to fly on worldwide demo tour

Honda Aircraft is preparing for a world tour with its HondaJet light business aircraft, ahead of planned US type certification and service entry in the coming months. The six-seat, \$4.5 million type – which secured provisional approval late last month – will make its first stop in Japan later this month, touring a number of key airports and special events.

The HondaJet will then continue to Europe, where it will make its first ever appearance at the EBACE business aviation convention on 19-21 May. Honda expects the GE Honda HF120-powered aircraft to travel to 13 countries during the tour and notch up more than 26,000nm (48,000km). The first HondaJet prototype flew in 2003. Since re-engining and other improvements, four flight test aircraft have flown more than 2,500h. The company’s final assembly line in Greensboro, North Carolina, is currently completing 12 aircraft, with a further five aircraft are in earlier stages of production.

PRODUCTION STEPHEN TRIMBLE
WASHINGTON DC

Boeing misses delivery target in first-quarter

Boeing delivered 184 commercial aircraft in the first three months of the year, falling short of the pace required to meet the company’s plans to hand over 750 to 755 aircraft this year.

First quarter deliveries included 121 737s, 30 787s, 24 777s, five 767s and four 747s.

If the three-month figure is annualised, Boeing is on track to deliver 736 aircraft in 2015, or 14 to 19 short of the company’s guidance to shareholders.

The first quarter shortfall was on the 737 assembly line. Boeing moved last year to increase 737 production to 42 aircraft per month, but in the first quarter of 2015 delivered at a monthly rate only slightly higher than 40. ■

E-JETS
E2
THE SECOND
GENERATION

Prepare for departures from the norm.

With our E-Jets E2 program well under way, it is time for a look inside, where well-conceived design for a new generation allows passengers to enjoy their own personal territory. This "space within a space" is achieved through clear delineation, advanced ergonomic engineering, and meticulous attention to detail throughout the sumptuous cabin. All to ensure each seat – and every crew station – is a great destination in itself. Leaving normal expectations far behind.



LOVE WHAT YOU FLY



Commercial Aviation



INVESTIGATION DAVID KAMINSKI-MORROW LONDON

Icing caused Swiftair stall

Engine sensors failed to transmit correct data to MD-83 crew ahead of fatal crash in Mali

Investigators believe that the crew of a crashed Swiftair Boeing MD-83 did not activate the engine anti-ice system before the aircraft entered a stall from which it failed to recover.

Icing of sensors in the engine resulted in incorrect data being transmitted to the aircraft's auto-throttle and limited the thrust delivered by its Pratt & Whitney JT8D engines.

French investigation authority BEA, citing calculations from the engine manufacturer, says that the data became erroneous on the right-hand engine about 2min after it levelled at 31,000ft.

Some 55s later the left-hand engine sensors similarly began transmitting incorrect information. As a result the engines did not generate enough thrust to maintain sufficient cruising speed. The aircraft slowed and began to pitch up automatically as it attempted to maintain its assigned altitude.

"Analysis of the available information indicates that the crew probably did not activate [the anti-ice] systems during the



The aircraft was operating a service from Ouagadougou to Algiers

climb and cruise," says BEA, in an inquiry update on the 24 July 2014 accident.

The aircraft's airspeed fell from 290kt to 200kt in the space of 5min 35s, causing the MD-83 to respond to the loss of lift by raising the nose.

As the airspeed bled away the aircraft eventually reached a critical angle of attack. It stalled and rolled suddenly to the left, rapidly losing altitude and crashing in Mali, with the loss of all on board.

No stall recovery manoeuvre was performed by the crew, says BEA, but the flight controls were

deflected to the nose-up and right-roll position.

The Swiftair aircraft had been operating a service from Ouagadougou to Algiers on behalf of Air Algerie, and had made a number of course adjustments in order to avoid convective weather.

BEA has identified at least two previous similar events – including one involving another Swiftair MD-83 which occurred just six weeks before the crash. During that incident, says BEA, the crew detected the loss in airspeed and activated the engine anti-icing system, preventing the situation from deteriorating. ■

SAFETY
DAVID KAMINSKI-MORROW
LONDON

EASA advises e-cigs ban for hold baggage

European safety authorities are recommending that carriers require electronic cigarettes to be carried in the cabin, over concerns about potential fire risks.

The European Aviation Safety Agency's advisory to airlines follows a similar warning from the US FAA in January.

Accidental activation of e-cigarettes has led to "several incidents" of fires

EASA says carrying e-cigarettes in cabins, rather than checked baggage, would allow fire incidents to be "immediately mitigated".

ICAO is considering an amendment to its formal technical instructions for safe transport of dangerous goods. It has already issued a bulletin warning that "accidental activation" of heating elements in e-cigarettes have led to "several incidents" of fire in checked baggage. ■



FLEET

Thai Airways retires its A340-600s

Thai Airways International has retired its final Airbus A340-600 from service. The type operated its last flights on the Frankfurt-Bangkok, Singapore-Bangkok, and Zurich-Singapore routes on 28 March. Flightglobal's Ascend Fleets database shows that the Star Alliance carrier had operated six A340-600s. It took delivery of its first of the type in June 2005, and its last in October 2008.

ENGINES STEPHEN TRIMBLE HARTFORD

PurePower all geared up for horizontal production

Pratt & Whitney has completed a transition to a moving, horizontal assembly line for the PurePower series of geared turbofan engines.

The assembly process at the P&W factory in Middletown, Connecticut, took months to re-vamp – and is now designed to keep pace with engine production rates, which are expected double within five years.

P&W has received orders and options by airlines for more than 6,300 PurePower series engines selected for five aircraft families, including the Airbus A320neo. Rather than build up engines in

vertical-oriented assembly jigs, the horizontal line advances engines through five assembly stations, with each station offering workers the ability to raise, lower and rotate the engines based on ergonomic needs.

Pratt & Whitney Canada has also installed a horizontal assembly line in Mirabel, Canada, where the PW1500G for the Bombardier CSeries and the PW800 for the Gulfstream G500/600 are being put together.

The ninth of 14 compliance engines for the A320neo recently became the first PW1100G to be assembled using the new system. ■



CLOSE TO HOME

Beyond groundbreaking color, PPG delivers service at jet-speed through a global network like no other.

To expedite product delivery and bring technical resources closer to our aviation customers, PPG offers global capability from 16 regional Application Support Centers (ASCs) around the world. Besides providing direct access to our market-leading coatings, sealants, and transparencies, ASCs offer rapid-response services such as color matching and blending, window systems assembly, chemical management, and value-added packaging for PPG coatings, sealants, and materials supplied by customers. What else does proximity enable? For one, the arrival of pre-mixed frozen sealants and customized sealant solutions that reduce process time and waste—technicians thaw only what's needed.

Visit ppginnovation.com/closetohome to learn how innovation at PPG is helping our aviation customers.



Scan to learn more.



PPG Industries

Bringing innovation to the surface.™

The PPG Logo is a registered trademark and Bringing innovation to the surface is a trademark of PPG Industries Ohio, Inc.
© 2014 PPG Industries, Inc. All rights reserved.



INCIDENT JON HEMMERDINGER WASHINGTON DC

Nothing amiss ahead of MD-88 crash

NTSB finds no pre-impact issues with aircraft that struck perimeter fence during snowstorm at New York's LaGuardia

Investigators have found no mechanical problems with the Delta Air Lines Boeing MD-88 that crashed at New York's LaGuardia airport on 5 March, but have provided more details about the botched landing.

"At this point, no pre-impact anomalies have been noted in the airplane structure, spoilers, thrust reversers or braking system," says the National Transportation Safety Board (NTSB) in an investigation updated released 2 April.

The aircraft was operating Delta flight 1086 from Atlanta when it crashed while attempting to land on runway 13 at about 11:02 local time during a snowstorm. The aircraft, registration N909DL, was properly aligned with the runway centerline and was flying at about 140kt during final approach, says the NTSB.



The Boeing came to halt with its nose extended over Flushing Bay

The autopilot was disengaged at about 230ft above the ground, and the main landing gear touched the runway centerline while the aircraft was travelling at 133kt, the NTSB says.

About 2sec later the thrust reversers on both JT8D turbofans were deployed and the engines began spooling up. Moments later the spoilers were fully de-

ployed, and within 2.8s of touchdown the brake pressure rose as the autobrake system engaged, says the NTSB.

But about 6s from touchdown the aircraft's heading began drifting left towards the runway's north edge, according to investigators. At about this point, the left engine reached a peak engine pressure ratio (EPR) of 2.07 and

the right engine peaked at 1.91 EPR, the NTSB says. Then, 9s after touchdown, the thrust reversers were stowed.

The NTSB notes that Delta's MD-88 pilot operational materials include guidance that engine EPR be limited to 1.3 while in reverse on a contaminated runway, but the agency does not say if the higher ratio contributed to the accident.

The agency says that 14s after touchdown the aircraft departed the left side of the runway. Its left wing struck a perimeter fence and the badly-battered fuselage came to rest with its nose extending over an embankment that runs along the shore of Flushing Bay.

The NTSB says 23 of the 127 passengers as well as five crew members on the aircraft suffered minor injuries. ■

EMPLOYMENT JON HEMMERDINGER WASHINGTON DC

Plea to FAA to outlaw United's 'gag order' on crew

A law firm is asking the US Federal Aviation Administration to prohibit airlines from using "gag order" provisions in employee confidentiality agreements, saying such language dissuades employees from reporting safety concerns and could hinder the FAA's ability to enforce regulations.

At issue is an agreement United Airlines required a number of flight attendants to sign as part of the airline's internal investigation

into safety concerns raised by the attendants, says law firm Katz, Marshall & Banks in a 3 April letter to FAA administrator Michael Huerta. The agreement prohibits the United employees from discussing the investigation with anyone but the airline, union representatives or their lawyers.

"If I fail to maintain the confidentiality set forth above, I can be subject to discipline up to and including the termination of my employment," the agreement says.

Katz, Marshall says such language leads employees not to report safety concerns. "We call on the FAA to immediately issue clear and decisive directives to airlines to discontinue the use of confidentiality agreements that impede the ability of employees to have an open and risk-free avenue of communication," the firm says in its letter to the FAA.

The law firm has also written to United. The carrier declines to comment on the case.

Katz, Marshall says it discovered the agreements while representing 13 United attendants who say they were fired by the airline for refusing to work a flight in July 2014. The attendants declined to fly after discovering the words "BYE BYE" and two menacing faces had been scribbled on an oil slick on the tail of the Boeing 747-400, according to a whistleblower complaint they filed with the US Occupational Safety and Health Administration. ■

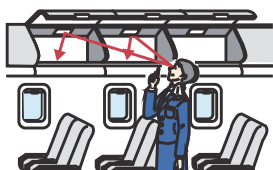
the first in the world!!

Wide field of view with flat surface

KomyMirror PAT.



Passenger Convenience



Shorten Aircraft Turns



Saving Non Productive Hour



Komy Co., Ltd.

www.komy.com

Global Flight Tracking **Today**

Over 50 Airlines Equipped

Enhance your communications with Spectralux Dlink+.

AOC Automated Position Reports ■ Condition-based Reporting Frequency



- Automated Position Reports
- VHF and SATCOM
- SATCOM Dialer/Interface
- All-in-one VDR/CMU/CDU
- Global Flight Tracking per ICAO 15 min Recommendation

STCs on Major Aircraft

Airbus	Boeing
A319	727
A320	737 Classic
A321	737NG
	757
	767

For more details, contact Spectralux at 1.425.285.3000
spectralux.com

Spectralux
avionics



FLEET MAVIS TOH SINGAPORE

China Airlines eyes 50 jets

Taiwanese carrier and regional affiliate look to narrowbodies for replacement and growth

China Airlines is evaluating an order for 50 narrowbody aircraft, to meet the needs of the mainline carrier and its subsidiaries in the medium term.

In an interview with *Flight International* in Taipei, chairman HH Sun said China Airlines and its regional subsidiary Mandarin Airlines will require 30 narrowbodies over the next five to 10 years. Twenty of these jets will be for replacement, while the remaining 10 will cater to the airlines' growth.

Sun disclosed that Mandarin, an all-Embraer 190 operator, will phase out its eight regional jets, replacing them with narrowbodies.

Low-cost carrier Tigerair Taiwan, in which China Airlines has a 90% stake, will meanwhile re-



Boeing 737 operator will choose between 737 Max and Airbus A320neo

quire 20 narrowbodies between 2018 and 2024.

Tigerair Taiwan has three leased Airbus A320s in operation and will take three additional jets on lease this year.

China Airlines, however, is a Boeing 737 operator. "So right now we're choosing between the A320neo and the Boeing 737 Max. We hope we can make a decision this year," says Sun. ■

STRATEGY MAVIS TOH SINGAPORE

Lucky Air puts its money on international network expansion

China's Lucky Air aims to more than double its fleet in the next five years.

In an interview with *Flight International* in Kunming, the carrier's head of the international development division Xiong Shuo says the plan is to grow to a fleet of 70 aircraft by 2020, by when the carrier will have introduced its first widebody.

Based in Kunming, Lucky Air has 26 narrowbodies – seven Airbus

A320 family and 19 Boeing 737 family jets – in service.

Plans for the induction of widebody aircraft come as the HNA Group subsidiary shifts its focus to building its international network.

"Right now with the narrowbodies, it restricts our flying to about five to six hours," says Xiong. "So in order to further expand our routes, we need widebody aircraft."

She adds that Lucky Air will look at launching services to southeast, south and east parts of Asia.

Xiong also says the carrier has plans to move towards a single fleet type for its narrowbodies: "The possibility of transiting to an all-Boeing fleet is larger, if we look at all angles including operating costs and performance. But this has not been confirmed yet; it's under evaluation." ■

MARKET

OLIVER CLARK LONDON

Alitalia loses out on home turf to surging Ryanair

Ryanair has become the largest airline operating in Italy by passenger numbers, figures for 2014 released by aviation regulator ENAC show.

The Irish low-cost carrier transported 26.1 million domestic or international passengers in Italy last year, while flag carrier Alitalia carried 23.4 million.

Ryanair was the largest carrier in international markets, carrying 17.2 million passengers.

Alitalia was the second largest with 10.5 million, closely followed by EasyJet, which carried 10.4 million.

However, in domestic markets Alitalia continued to dominate, carrying 12.8 million passengers. Ryanair's figure was just under nine million and EasyJet's just under three million. ■



The low-cost carrier overtook flag carrier Alitalia in 2014

Direct To the Fast Lane

Equip with Universal Avionics WAAS/SBAS-FMS and go direct-to the fast lane with one of over 3,100 LPV procedures available worldwide.



UNIVERSAL AVIONICS
SYSTEMS CORPORATION

(800) 321-5253 (520) 295-2300
uasc.com



What are you doing to lower maintenance costs
and keep your aircraft flying?



Here's what we're doing. Good maintenance planning will help lower costs and get your aircraft where you need it: flying and earning. Come straight to Spirit AeroSystems, the factory-original parts and maintenance source that shares your goal. Our licensed parts provide the cost savings you want, with the reliability and quality you expect. Visit us at MRO Americas, booth #3400 or at spiritaero.com.



Global Customer Support & Services

Original Production Manufacturer | Spares/Rotable Assets | Global Distribution

Maximizing your vision is our vision.



At Rockwell Collins, we're always looking forward – and so are our solutions. Like the head-worn technologies that provide unprecedented situational awareness to military aircraft pilots via fused sensor imagery. Or our head-up guidance systems (HGS™) that combine synthetic and wide-spectrum infrared vision to make whiteout conditions appear clear as day. And even the predictive features of our new MultiScan ThreatTrack™ weather radar, helping you see threats of turbulence, lightning and hail, before they happen. All to help you see the right information at the right time, every time.

rockwellcollins.com/maximizingvision

© 2015 Rockwell Collins. All rights reserved.

**Rockwell
Collins**

Building trust every day



RSAF gets up to speed with Elbit Hermes 450 UAV fleet
DEFENCE P22

INCIDENT DAVID KAMINSKI-MORROW LONDON

Warning on outdated GPWS

FAA says latest terrain-alert software could have helped prevent 2013 UPS freighter crash

Safety authorities are advising operators to ensure they have the latest software for enhanced ground-proximity warning systems, in the wake of the August 2013 UPS freighter crash in Alabama.

Although the Airbus A300-600F, which struck terrain while attempting to land at Birmingham, had been fitted with an approved Honeywell warning system, it did not feature the most recent available software.

If the software on the jet had been updated, the aircraft would have entered the terrain alert envelope about 200ft above the ground, some 1.3nm (2.4km) from the runway threshold.

The crew of the A300 received a “sink rate” warning about 8s before an initial collision with trees, with a “too low, terrain” caution sounding just after the strike.

In a 13 March bulletin, the US Federal Aviation Administration



Software for the A300's warning system was not the latest version

states that the latest software would have provided a “too low, terrain” alert 6.5s earlier, when the aircraft was 150ft higher.

“Although it is not clear if the later version of the software would have prevented the accident, it would have provided a significantly improved margin of safety,” it adds.

The bulletin, which has also been highlighted by EASA, has not been elevated to a formal airworthiness directive.

US National Transportation Safety Board investigators pointed out that the A300's high descent rate would nevertheless have “compromised” the effectiveness of the warning system, even with the updated software.

But their analysis of the August 2013 crash determined that an immediate activation of the go-around switch, or an aggressive manual response to the terrain alert, would have enabled the aircraft to avoid the impact. ■

FINANCING

Tax treaty boost for Hong Kong's leasing market

Hong Kong's bid to grow its aircraft leasing industry has got a boost with a 1 April revision to the city's double taxation treaty with China, that sees the two cut the withholding tax liability on aircraft leases from 7% to 5%.

“This will be conducive to the promotion of aerospace financing business in Hong Kong, and we will continue to explore other measures,” says Hong Kong's secretary for financial services, Professor KC Chan.

Hong Kong's Economic Development Commission has been working on a wider package of incentives for the aircraft leasing industry, which are expected to go before its legislature soon.

The city's chief executive CY Leung, in a speech in January, highlighted the push to grow the aircraft leasing industry, which he said will “strengthen Hong Kong's status as an international aviation and financial centre”.

Hong Kong has been a hotbed for aircraft investments in recent months, with the Chow Tai Fook group and NWS Infrastructure taking 40% holdings each in the Investec-managed Goshawk Aviation portfolio entity. That followed Cheung Kong's entry into the leasing market last November, when it announced the acquisition of nearly \$2 billion worth of aircraft from three lessors. It also announced a joint venture with MC Aviation Partners.

In June 2014 Hong Kong-based China Aircraft Leasing (CALC) debuted on the Hong Kong stock exchange, making it Asia's first listed lessor. CALC's focus has been on the Chinese market, counting carriers such as Sichuan Airlines, China Eastern Airlines and Chengdu Airlines as clients, though this year it will add Air India, with a delivery of five A320s.

Hong Kong- and China-based lessors are expanding thanks to cheap debt and a strong appetite from Asian airlines to take on operating leases and conduct sale-and-leaseback transactions. ■

SHAREHOLDING MICHAEL GUBISCH LONDON

Darwin evolution clears Etihad for deal

The regulator in Switzerland has approved Etihad Airways' one-third shareholding in Darwin Airline after the Lugano-based turboprop operator abandoned a strategy of expanding scheduled services in co-operation with the Gulf carrier and European partners.

“Under the new business model, Darwin's operational dependence on Etihad has been significantly reduced,” says the Swiss Federal Office of Civil Aviation.

In January 2015 – a year after it had been rebranded as Etihad Regional – Darwin revealed plans to terminate the majority of its European scheduled flights and concentrate on wet-lease operations for Air Berlin and Alitalia, both of which are partly-owned by Etihad. A limited number of scheduled domestic services and routes to Italy will be continued, however.

Darwin blamed “aggressive” competition from Lufthansa Group carrier Swiss International

Air Lines for the change in strategy. Swiss has wet-leased turboprops from group sibling Austrian Airlines to compete with Darwin on several routes.

Last year, FOCA launched an ownership and control probe into Darwin's tie-up with Etihad. The authority objected that the deal would have led to “considerable financial dependence” on the Abu Dhabi-based airline, and not be compliant with EU regulations.

FOCA completed the investigation after Darwin's change of strategy. But the regulator warns it will re-examine the airline should co-operation terms with Etihad be significantly changed.

The revised partnership will provide “financial stability for the long-term growth” of Darwin and dispel “any market uncertainty”, says Darwin chief Maurizio Merlo. ■



Switzerland has approved Etihad's share in the rebranded Darwin



ROTORCRAFT

US Army brings back Apache's Stinger potential

After Boeing announced the delivery of the 100th AH-64E Apache helicopter on 30 March, the US Army is already planning a new round of upgrades.

A decision on whether to replace the AH-64E with a high-speed rotorcraft – the Future Vertical Lift – or perhaps re-engine the existing gunship remains at least a decade away.

In the meantime, the AH-64E will regain the ability to fire the Raytheon Stinger missile as a self-defence weapon if attacked by other aircraft. The US Army has no current requirement for it on the AH-64E, but the capability will be available, says Col Jeff Hager, Apache programme manager. The army removed the Stinger from the wingtip of the AH-64E to install self-defence equipment.

The South Korean government, however, is paying to re-integrate the missile for its army's AH-64E fleet under a \$35 million contract that was announced in March.

The sale is part of the \$1.6 billion Foreign Military Sales package for 36 Apaches that was contracted in 2013, and deliveries of the weapon will begin in 2017. In 2013 Seoul noted that 63 Block I 92H Stingers were required, although Raytheon did not disclose numbers in its contract announcement.

The US Army, meanwhile, will soon begin soliciting contractors for a new Apache self-protection system against small arms. The ground fire acquisition system, which alerts the flightcrew to incoming fire by bullets and rocket-propelled grenades, will be acquired with money added to this year's budget by Congress.

Boeing is set to deliver Version 6 of the AH-64E software this year. This will add a cognitive decision aid in the cockpit that will automatically adjust the flight-plan if sensors detect unexpected threats along the original route, Hager says. The new software will also improve the fire control radar and introduce the soldier networking radio waveform. ■

UNMANNED SYSTEMS BETH STEVENSON LONDON

RSAF gets up to speed with Elbit Hermes 450 UAV fleet

Ceremony marks full operational capability milestone, eight years after delivery of system

Some eight years after the system was delivered, the Royal Singapore Air Force's Elbit Systems Hermes 450 unmanned air vehicle fleet has reached full operational capability (FOC).

Since the delivery of the UAV to RSAF's 116 Sqn in May 2007, the pilots, engineers and maintenance crew have undergone "intensive training" to allow them to operate the aircraft in line with RSAF procedures, Singapore's defence ministry says.

A ceremony to mark the FOC achievement was held at Murai Camp on 30 March, at which defence minister Ng Eng Hen was in attendance.

The Hermes 450 was acquired to supplement the air force's Israel Aerospace Industries Searcher



The Elbit Systems unmanned air vehicle provides a 3-in-1 payload

and Heron 1 UAVs by providing a vehicle with longer endurance, advanced avionics and better sensors. Key to this is the 3-in-1 payload, which combines electro-op-

tical, forward-looking infrared and a laser designator in one pod, allowing for target acquisition and designation, reconnaissance and battle damage assessment. ■

REQUIREMENT BARTOSZ GLOWACKI WARSAW

Warsaw wants to arm Watchkeepers

Thales has proposed teaming with Polish industry to offer a weaponised version of the WK450 Watchkeeper unmanned air vehicle for Warsaw's tactical UAV requirement.

Under the proposal, the British Army's surveillance UAV would be adapted by Polish partners – potentially Polska Grupa Zbrojeniowa, the Institute of Aviation, WB Group, WZL-2 and Mesko – to integrate Thales' free-fall lightweight multirole missile (LMM).



Thales says the adapted model could carry four free-fall LMMs

Matt Moore, head of Thales UK's UAS business, says that Watchkeeper would be able to carry four free-fall LMMs on two underwing hardpoints.

Poland wants to acquire 12 tactical UAVs through the "Orlik" (Eagle) programme acquisition, with aircraft to be delivered by 2022.

Purchase of an additional batch of the selected type is planned between 2022 and 2026, while a selection decision and contract signature is expected during 2016, according to a defence ministry notice for the programme issued in January.

Polish Watchkeeper industrial activity for Thales' proposal would include flight management; system integration; manufacture of aircraft, including composite fuselage, wings, tails and landing gear; airfield shakedown flights; and handover to customer; as well as engineering development and supply chain management.

Thales representatives say that throughout manufacture a "restricted zone" would be established so that Poland can integrate its encryption hardware and software. Poland will own the rights for all encryption modifications and modernisations developed and implemented under the development, the company notes.

Warsaw University of Technology has also been contracted to co-operate with Thales on UAV radar technologies, flight simulations, drive technologies, applications in civil services and man-machine interface.

It is understood that the integration and Polish military authority certification of LMM on Watchkeeper could be completed within 18 months once an agreement is signed. Financing will be by means of a loan guaranteed by the British government, Thales says. ■



**Pseudo satellite
warms up for
market**
DEFENCE P25

PROGRAMME STEPHEN TRIMBLE WASHINGTON DC

USA reveals plans to buy 477 F135s

The F-35 joint programme office (JPO) has revealed the first details of a three-year, block-buy proposal for the Pratt & Whitney engine that powers the Lockheed Martin fighter.

The JPO could sign contracts for 477 F135 engines over a three-year period from FY2017, according to a notice posted online on 25 March. A JPO spokesman clarifies the 477 excludes spares, so it could be matched by an equivalent number of airframes.

The details of the block-buy proposal were not revealed previously as the US Congress has not

yet authorised the approach, and some of the international partners have not made formal commitments to acquire the aircraft.

Acquisition rules require the JPO to notify the industry of potential sole-source contracts. The US Department of Defense typically buys aircraft and engines in annual lots through the end of low-rate initial production. Once production costs have stabilised during full-rate production, programmes sometimes shift to multi-year procurement, but only if the contractor agrees to deliver a minimum discount of 10%.

The timing of the three-year block buy, however, begins in the final year of low-rate initial production in FY2017, so the JPO needs specific authorisation from Congress for the deal. The JPO is currently authorised to negotiate a

block buy of nearly 150 F-35s, expected to be ordered between FY2015 and FY2016.

Meanwhile an interim fix for a critical safety problem in the F135 engine could soon become permanent or be replaced by a re-designed system, P&W says.

In mid-year, the engine manufacturer will re-evaluate the interim solution that addresses the "blade rubbing" issue that caused a fire on an F-35 last year and grounded the fleet for three weeks.

Investigators traced the problem to the third stage integrally-bladed rotor, where blades rubbed against a polyimide foam seal on manoeuvres well within the operating envelope of the single-engined fighter. The fleet returned to limited flight and last September programme officials implemented an interim fix. ■

**The JPO could sign
contracts for 477
F135 engines over a
three-year period**

ROTORCRAFT GREG WALDRON SINGAPORE

DSCA approves the sale of 15 AH-1Z Vipers to Pakistan

Package of attack helicopters, missiles and support equipment offered to Islamabad

The US government has approved the possible sale of 15 Bell Helicopter AH-1Z Viper attack helicopters to Pakistan, with the package to include 1,000 Lockheed Martin AGM-114R Hellfire II missiles.

The \$952 million package would be conducted under the US Foreign Military Sales programme, says the US Defense Security Cooperation Agency (DSCA) on its web site.

"This proposed sale will provide Pakistan with a precision strike, enhanced survivability aircraft that it can operate at high altitudes," says the DSCA.

"By acquiring this capability, Pakistan will enhance its ability to conduct operations in North Waziristan Agency, the Federally Administered Tribal Areas, and other remote and mountain-



The aircraft offer a precision strike capability with Hellfire missiles

ous areas in all-weather, day-and-night environments. Pakistan will have no difficulty absorbing these helicopters into its armed forces."

In addition to the helicopters and missiles, the package in-

cludes mission computers, target sight systems, 20mm guns, spare engines, and other equipment. The package also covers logistics, training, and other support.

The deal does not include any offsets, adds the DSCA. ■

TECHNOLOGY
BETH STEVENSON LONDON

DARPA project seeks to speed up integration

In an effort to avoid expensive new technology becoming obsolete as a result of slow integration, the US Defense Advanced Research Projects Agency (DARPA) has launched a project to explore the quicker integration of new systems with existing technology.

The System of Systems Integration Technology and Experimentation (SoSITE) project will "develop and demonstrate concepts for maintaining air superiority via novel SoS architectures", combining aircraft, weapons, sensors and command and control systems with existing manned and unmanned aircraft.

"As advanced technologies become more readily available to adversaries on commercial markets, the nation's focus on ever-more complex weapons systems has become not just a strength but also a weakness," DARPA says.

"US military systems today are often too expensive to procure in the quantities needed, and may take so long to develop that their components are obsolete by the time they become operational."

Concept development contracts have been awarded to Boeing, General Dynamics, Lockheed Martin and Northrop Grumman, which are developing SoS architecture technology and flight experimentation plans. In addition, Apogee Research, BAE Systems and Rockwell Collins are developing tools to enhance current open-system architecture approaches.

SoSITE will seek to take advantage of advances in miniaturisation, increased capability and the decreased cost of electronics and new algorithms and software technology.

"Cost savings may be realised by separating payload from platforms, thereby allowing defence planners greater flexibility in choosing cost-versus-capability trade-offs for each," DARPA says. ■

51st INTERNATIONAL PARIS AIR SHOW

Paris • Le Bourget

FROM 15 TO 21 JUNE, 2015

Where aerospace leaders
get down to business



Design: Navasár - Photo credit: Getty Images

an event from
GIFAS 

 **siae.fr**



SPn founder talks up
light jet's return
BUSINESS AVIATION P27

UAV BETH STEVENSON FARNBOROUGH

Pseudo satellite warms up for market

Next generation of first UK military-registered HAPS to go on sale as Airbus plans launchpad network for solar-powered Zephyr

Airbus Defence & Space is preparing for full commercial operations of its Zephyr high altitude pseudo satellite (HAPS), envisioning the establishment of launchpads that could deploy an aircraft anywhere in the world within 24h.

The company is in the process of building a prototype of the next generation of the system – the Zephyr 8 – which will be ready “by the end of the year” and will be the first variant available for customer purchase.

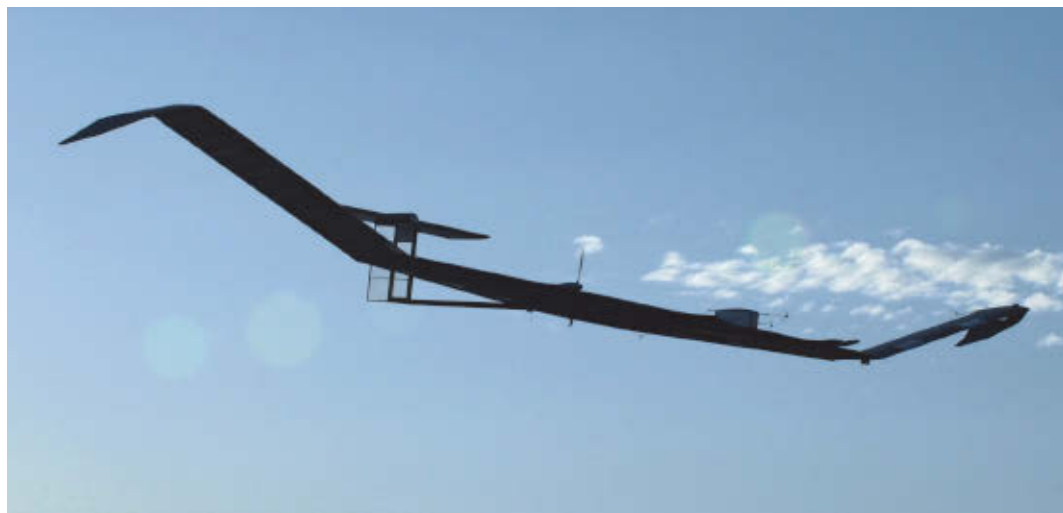
Zephyr, which relies on solar power that is stored during daylight and utilised at night, is a year-long operated lightweight (50kg) surveillance aircraft that is best launched in good weather conditions. As such, five undisclosed launch locations have been earmarked to provide suitable conditions for the aircraft's operations.

Zephyr 8's predecessor, the Zephyr 7, underwent testing with the UK Ministry of Defence in 2014 at an undisclosed location in the southern hemisphere. It remained aloft for 11 days, reaching an altitude of some 70,000ft, and was the first HAPS to receive a UK Military Aviation Authority registration – PS001.

Notably this happened in winter conditions, so days were shorter and nights were longer, thus putting more stress on the system. Satellite communications were also tested during the flight, which demonstrated a reliable communications link, Airbus says.

Furthermore, the company is focusing on developing a system that will be certifiable within national airspace.

In 2014, the older Zephyr 6



Airbus Defence & Space

Zephyr 7 remained aloft for 11 days, reaching an altitude of some 70,000ft, in 2014 tests with the MoD

variant was tested in Dubai in coordination with the Emirates Institute for Advanced Science and Technology. A 30h flight test was conducted in civil airspace with the permission of the Dubai Civil Aviation Authority.

“It was well worth the effort on both sides getting this through the certification with the MoD”

PAUL BROOKS

HAPS head of business development and sales, Airbus Defence & Space

Procedures and quality assurance are routine to Airbus because of its experience in developing military and commercial satellites, says Paul Brooks, HAPS head of business development and sales at Airbus Defence & Space, so redundancy and safety measures have been

incorporated within the design from the start.

The company is looking to aggregate a number of flight hours in order for the Zephyr to be regulated. It also says that Zephyr acts similar to a glider on descent – “like a shuttlecock” – and therefore poses a low level of risk should it unintentionally descend.

“In principle the flight path is entirely predictable from launch,” says HAPS technical director and flight operations manager Christopher Kelleher. It typically takes 7h to ascend to 60,000ft.

Brooks adds: “It was well worth the effort on both sides getting this through the certification with the MoD.”

Zephyr can carry a 5-10kg payload, which can range from electro-optical/infrared and communications relay to ground radio frequency monitoring. The same payload capacity is found in the

Zephyr 7 and 8, but the 8 can fly it for longer due to increased battery performance and solar cells with three times the performance of those found in the 7.

“There is nothing fundamental about the physics of optics that says they have to be heavy,” notes Kelleher.

Four Zephyr 8s will be built initially, and an aircraft with a suite of payloads will be ready for testing should a customer require it. A single 40ft (12m) ISO container will carry three Zephyrs and one ground control system, and it will take two pilots to fly four Zephyr 8 aircraft.

Zephyr was originally a Qinetiq research project, but was sold to Airbus in 2013 so that the latter could develop it into commercial platform using its satellite experience. Development by Airbus continues at Qinetiq's site in Farnborough, UK, where commercial manufacture of the HAPS is expected to begin. ■

**Download the 2015
World Air Forces Report**
www.flightglobal.com/waf

IN ASSOCIATION WITH

**Together
ahead. RUAG**



15TH ANNUAL

EBACE

19-21 MAY 2015 | GENEVA

Join European business leaders, government officials, manufacturers, corporate aviation department personnel and all those involved in business aviation for the 15th annual European Business Aviation Convention & Exhibition (EBACE2015).

Visit the EBACE website to learn more and register today.

www.ebace.aero/flightinternational





IAI unveils composite testing system
NEWS FOCUS P28

RELAUNCH KATE SANSFIELD LONDON

SPn founder talks up light jet's return

Seven years after collapse of programme's developer, ExecuJet chairman says recovering market may clear way for revival

The owners of the Grob SPn are looking to resurrect the light business jet programme, seven years after the project was halted following the insolvency of its developer, Grob Aerospace. The company was later relaunched as a training aircraft business under the name Grob Aircraft.

"The climate is more favourable to the light jet sector now," says Niall Oliver, co-owner of Allied Aviation Technologies, which retains the design and brand rights to the SPn, as well as two flying prototypes, two in-build aircraft and tooling. These are all stored in Germany, where one of the prototypes continues to fly on a regular basis.

Oliver admits that the lower end of the business aircraft market has struggled since the 2008 downturn, hampering any attempts to revive the SPn – which had an orderbook of 100 before Grob's collapse.

The launch of the Pilatus PC-24 in 2013 and the over-

whelming market response to the "super versatile" light twin, however, has provided a catalyst for the rethink.

"The PC-24 has endorsed the concept for a utility business jet like the SPn," says Oliver, who is also chairman of business aviation services provider ExecuJet Aviation. "Although the PC-24 is bigger, the SPn is as versatile [it can land on paved or unpaved runways] and has a similar range."

"The SPn is still incredibly well placed in the market. With the light business jet sector start-

ing to recover, this could be the time to resurrect the programme," he adds.

Oliver says reviving the all-composite twinjet could come about through a partnership with an existing manufacturer or by selling the programme to an interested party.

Meanwhile, Oliver says he is unable to comment on the rumour that ExecuJet is about to be sold to leading European charter company Luxaviation.

"All I can say is that the charter industry is too fragmented and

desperately needs consolidating," he asserts.

Twenty-year old ExecuJet is one of the biggest business aviation services providers in the world, with a charter and management fleet of around 160 aircraft along with 19 fixed base operations and a dozen maintenance facilities worldwide.

Luxaviation is also remaining tight-lipped on the speculation, but it has made no secret of its ambition to become the largest business aircraft operator in the world after NetJets.

The Luxembourg-based company plans to boost its fleet from 100 to 500 aircraft by the end of the decade through what it calls "strategic acquisition" of operators across the globe.

Six-year-old Luxaviation started down the acquisition trail in October 2011 with the purchase of Germany's FairJets. Since then it has snapped up four other European operators, including the UK's London Executive Aviation. ■



The SPn had an orderbook of 100 before Grob Aerospace folded

FRACTIONAL OWNERSHIP KATE SANSFIELD LONDON

NetJets gets Embraer's 100th US-built Phenom

The 100th Phenom to be assembled at Embraer's facility in Melbourne, Florida, has been handed over to the airframer's largest customer, NetJets.

The fractional ownership company took delivery of the Phenom 300 – its 40th example of the light business jet – on 2 April. The aircraft – registration CS-PHF – will enter service with NetJets' European sister company this month, along with another of the seven-seat types.

The Berkshire Hathaway-owned company signed a contract in 2010 for up to 125 Phenom 300s, including 50 firm orders, as part of a \$17.6 billion top-to-tail overhaul of its 500-strong global fleet.

The twinjet forms the backbone of NetJets' light-cabin offering and is the fastest-selling business jet in the operator's almost 30-year history.

The popularity of the Phenom 300 persuaded NetJets late last year to convert 10 of its 75 Embraer Phenom 300 options into firm orders at a cost to the US company of around \$90 million.

According to NetJets, its Phenom 300 fleet has notched up over 23,000h since the first aircraft entered service in May 2013.

Embraer began Phenom production in Melbourne – its only assembly facility outside Brazil – in 2011 and delivered the first aircraft, an entry level Phenom 100, later that year. ■

REGULATION DAVID LEARMOUNT LONDON

Single-engine IFR ruling nears

ESA has completed its review of industry comments on the controversial subject of commercial single-engine turbine operations in instrument meteorological conditions (CAT SET-IMC), and expects to publish its final opinion "in the third quarter" of this year for rulemaking by the European Commission in 2016.

The subject attracted about 150 comments, the majority of which were in favour of CAT SET-IMC, but traditionally conservative states such as Germany and the UK continue to express outright opposition or scepticism.

The objections are based on two main premises: passengers cannot be guaranteed a safe forced landing in IMC or at night in the event of the single engine failing; and a forced landing in

highly populous areas such as the UK's southeast risks casualties on the ground.

The arguments in favour are based on aircraft providing equivalent or better safety than permitted CAT IMC operations by twin-engined piston aircraft, especially among single-turbine types that are equipped with advanced satellite navigation combined with a terrain database and with boosted standby electrical power.

This rulemaking has been in discussion for more than 15 years, and now there are 12 aircraft carrying out commercial SET-IMC operations in Europe under exemptions agreed by the individual countries.

If the rulemaking goes ahead, operators will have to obtain special authorisation. ■



The system has accumulated 2,000h of flight time on the Israeli air force's Heron TP

MAINTENANCE ARIE EGOZI TEL AVIV

Composite MRO...without the stress

IAI uses embedded fibre-optic strain-sensing to monitor UAV health and enable non-destructive component inspection

Their high strength-to-weight ratio, corrosion resistance and fatigue strength make composite materials an excellent candidate for use in unmanned air vehicle structures.

To this end, all of Israel Aerospace Industries' UAVs – from the smallest to the largest – are made from composites, although the stress on some components, such as the wing, poses problems for maintenance.

Conventional inspection procedures are difficult to apply in the case of complex composite-based structural components, and available non-destructive testing methods require highly trained technicians, which results in high operating costs.

In an exclusive presentation for *Flight International*, Moshe Medina, IAI's executive vice-president and general manager of its engineering and development group, unveiled details of IAI's new fibre-optic strain-sensing health monitoring system for UAVs, which is built using Rayleigh backscattering distributed strain sensing technology.

"The new system is based on an embedded fibre-optic that measures the strain distribution on the wing due to external loading," Medina explains.

He says that their small diameter means fibre-optics can easily

be embedded within large composite material-based structural components: "They are flexible, passive, tolerant to environmental conditions and insensitive to electromagnetic disturbances."

Medina says that one of the methods is based on measuring the Rayleigh backscattering – in fibre-optics, this effect is caused by random fluctuations in the refractive index of the fibre – as a function of location along the fibre.

The amplitude of the backscattered light as a function of distance is random, but is fixed for any given fibre at a given layout of the fibre, Medina says.

An external stimulus, such as mechanical strain or change in the temperature, causes a shift in the local reflected optical spectrum. With a spatial resolution on the order of a centimetre, one can monitor strains over tens of metres of standard single mode optical fibres without the need for any preparations.

MONITORING

The structural health monitoring of the wing is performed by comparing the strain signature – measured by the optical fibre – under the same loading condition, at different times during the UAV's service.

When the different UAV parts are being built in IAI's composite

department, the fibre-optic is embedded into the wing spars and other fuselage parts in spots that tend to develop strain damage.

This system has been embedded in all of the company's Heron TP UAVs – the largest type manufactured by the company – monitoring the health of all the front wing spars of the aircraft.

"We already know that the system has increased the mean time between inspection by 20%"

MOSHE MEDINA

Executive vice-president of engineering and development, IAI

After each flight or series of flights, the end of the fibre-optic is connected to a device loaded with the special algorithm that translates the input from the embedded system, turning it into data that can point to areas that need attention.

"We already know that the system has increased the mean time between inspection by 20%," Medina notes.

The easy access to the data enables preventive maintenance, and, according to Medina, takes the possible human error involved in other methods of periodical inspections "out of the loop".

Health management of UAVs, according to Medina, is crucial: "In a manned platform, the pilots are also sensors that can detect evolving failures. In an unmanned system the health system is alone."

The new fibre-optic-based health system is not affected by light, ensuring precise readings even in harsh weather.

The system is already installed on the Israeli air force's Heron TP, and has so far accumulated some 2,000h of flight time. According to the development team, in a sequence of 1,000h, there were no false indications.

It is now being installed in IAI's UAVs, but other uses are already being evaluated, such as for monitoring composite fuselage sections of helicopters after cracks have been found and fixed. IAI has also used it to test its Gulfstream G280 business jet that is approaching the end of its fatigue test series.

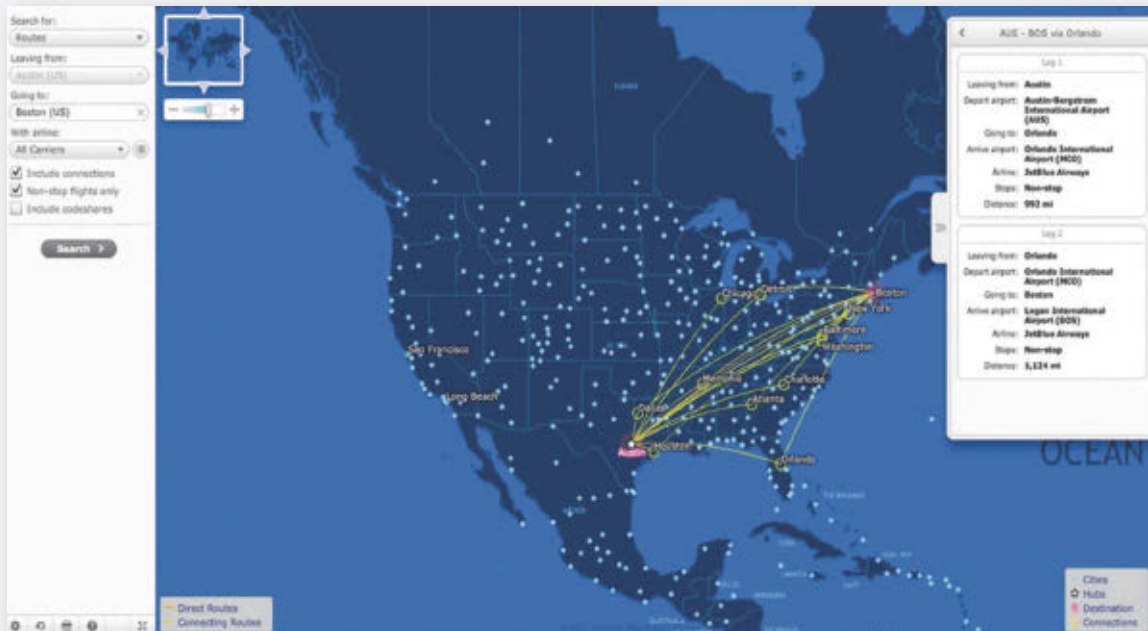
Positive results have encouraged IAI to take the system to other activities of the company, such as the conversion of passenger aircraft to aerial tankers, cargo aircraft or special mission aircraft. Medina and his team say that the fibre-optic-based health system is a "revolution" that will be found in many aeronautical programmes in the future. ■

innovata

Part of  Flightglobal

Innovata joins Flightglobal

You may have read that Flightglobal has acquired the schedules data services company, Innovata. As a leading source of airline schedules data covering more than 800 carriers worldwide, Innovata builds, hosts and maintains a wide range of electronic timetable and route network mapping solutions.



Innovata powers timetable and mapping services for some of the best known names in air travel and transportation, from the global airline alliances through to airports and a host of online travel sites.

To find out more visit www.innovata-llc.com

THE RIGHT TOOLS FOR THE JOB

North America's MRO providers have been caught lagging when it comes to investing in technology. Are they ready to respond to the challenge of industry innovation?

JOHN HEMMERDINGER WASHINGTON DC

In recent years, the North American maintenance, repair and overhaul business has been relatively stable and predictable, growing modestly in line with carriers' fleet plans while capturing incrementally more work from overseas operators, say experts. But times may be changing.

Observers say that apart from being increasingly squeezed by powerful OEMs, MRO providers risk being left behind by rapidly-developing technologies. They urge MRO shops to invest in research and development, citing the need to keep pace with technologies like three-dimensional printing, predictive maintenance, aircraft health management and advanced mobile devices.

"Early indications are that MROs are continuing to cede ground to other industry participants," Andrew Medland, a principal at consulting company Oliver Wyman, tells Flightglobal. He points out that a recent

industry survey confirms MRO shops tend to invest relatively little on R&D and tend to see themselves as slow to react to new technologies. "MRO operators are not that quick to jump on new technologies," says Medland.

The results of that survey have not yet been publicly released, the company says.

Meanwhile, the fuel price decline has left a bull's eye on maintenance costs, which now account for a greater share of airlines' costs, insiders note. And airlines, most of which are now solidly in the black, finally have the cash they need to invest in maintenance efficiencies, they add.

CONFLUENCE

"You have this confluence of technology and money," says Kevin Deal, vice-president for aerospace and defence at software provider IFS North America. "You have a lot of things that are starting to happen."

"Airline operators are not necessarily throwing that cash back to investors. They

know they need to invest to make themselves more competitive," Deal adds.

Medland at Oliver Wyman says a coming "wave of disruptive technology" is likely to make business as usual increasingly problematic for MROs.

Technological improvements in recent years have largely been led by aircraft and engine manufacturers, which collect data from sensors on the aircraft and engines they make, he notes. "That is ceding a massive amount of advantage to one industry participant," says Medland. "That data will create all sorts of insights."

Armed with ever-increasing loads of data, OEMs are developing improved aircraft health management systems and predictive maintenance technologies, which can help carriers fix problems proactively, says Medland. Three-dimensional printing – also known as additive manufacturing – is also maturing, and promises to help airlines and parts manufacturers more quickly design and





Large numbers of 757s, MD-80s and A320s will be retired in the next 10 years

produce improved components, experts say. In addition, artificial intelligence systems may soon enter the mix, says Medland, adding that these developments should be a “call to arms” to MRO providers.

“There is still some time to get a strategic grip on some of those technologies,” he says. “The next winners will be those that out-innovate their competitors.”

Deal says MRO shops might consider investing in mobile or even “wearable” computers. Technicians working on the flight line can use such devices to snap and send pictures to more senior (and more expensive) off-site technicians, who can help diagnose problems and determine fixes, he says. The devices could even be worn on the wrist like a watch, and have voice recognition technology. “If a person has two wrenches in their hands, it is tough to punch buttons,” Deal says.

The computers could also transmit simple notifications to technicians or provide >>



Air Transport Services, based in Everett, Washington, has been expanding its facilities

» specifications like torque settings, without overloading them with too much information. “If that person knows, via the device in their hand, that something else is due in a day or two, why not effect that fix now?” Deal says.

Despite indications of being slow to adopt new technology, the North American civil MRO industry continues to grow at a pace observers describe as modest. The business in North America will be worth some \$20.1 billion this year, but will dip slightly between now and 2020 before resuming growth and reaching \$21.3 billion by 2025, a 10-year annual growth rate of 0.6%, according to a report released 18 March by the Aeronautical Repair Station Association and Cavok, a division of Oliver Wyman.

“The next winners in MRO will be those that out-innovate their competitors”

ANDREW MEDLAND

Oliver Wyman

By comparison, the global MRO business will be worth \$67.1 billion this year and increase about 4.1% annually, hitting \$100 billion in 2025, the report says. The North American commercial fleet included about 7,300 aircraft in 2014 and will increase an estimated 0.6% annually to 7,942 aircraft by 2024, according to a 2014 MRO business planning study from consultancy Team SAI.

Between now and 2024, North American carriers will take delivery of an estimated 3,735 new aircraft, of which about 2,100 will be narrowbodies, about 474 will be widebodies and the remainder will be turboprops and regional jets, according to that report.

All those new aircraft will mean MRO providers will need to receive new certifications, and invest in new tools and training, it adds. And new aircraft types will likely have longer maintenance intervals, meaning MRO shops may need to diversify or modify their businesses in response to periods of lower demand, says the report.

EXPANSIONS

Meanwhile, over 10 years, North American airlines will retire some 2,979 aircraft, including large numbers of Boeing 757s, MD-80s and Airbus A320s, the report predicts.

The health of the industry has been reflected in recent months by US expansions. AAR, based in Wood Dale, Illinois, is seeing “healthy activity” at its new facility in Lake Charles, Louisiana, which opened one-and-a-half years ago. Earlier this year the company opened a new hangar at the site capable of housing an A380. »

AUTOMATION MICHAEL GUBISCH HAMBURG

LUFTHANSA CRAFTS ROBOTS TO DO THE WORK

LUFTHANSA TECHNIK is developing automated inspection and repair techniques for engine components in an effort to raise productivity compared with traditional manual processes.

Together with Hamburg’s technical university, research organisation Fraunhofer and industrial partners, the maintenance, repair and overhaul division of Lufthansa has developed a robot to examine the outer liner of combustors on CFM International CFM56 engines, under a project dubbed AutoInspect.

INDUSTRIALISATION

The technology, however, could also be a “door opener” to deployment of robots for inspection of other power-plant components, such as fan blades, casings and aerofoils in both the compressor and turbine, says project manager Michael Ernst.

White-light interferometry is applied in the fully automated process. The partners have adapted the long-established measuring method for component inspections in an initial research project that began in 2011.

Lufthansa Technik has since installed a robotic unit at its Hamburg headquarters as part of an industrialisation phase. Inspection times for combustor liners could be reduced from an average of four work shifts – more than two days – to less than 4h, says Ernst.

Handling enormous data volumes has been a challenge in using white-light interferometry in the past, as the method generates around 130,000 images during the inspection of a combustor liner. But this has been overcome with increasing computer performance.

Enabling the robot to differentiate between surface



Inspection times for combustor liners could be halved by using highly sensitive systems to take measurements

scratches and micro-cracks has been another challenge, says Ernst. But programming such software has helped to categorise signs of damage more clearly and determine whether or not defects require repairs, he adds. During manual inspections, that assessment depends on technicians’ individual experience.

In 2012, the research partners started a parallel project dubbed AutoRepair, under which Lufthansa Technik is now preparing to install another robot to conduct fully automated repairs.

A two-year industrial trial is set to begin in the fourth quarter of 2015, says team leader Thiemo Ullrich. It is not yet decided whether that set-up will comprise separate milling and welding robots or a combined unit with different tooling, or utilise an existing CNC [computer numerical

control] facility at the MRO specialist. The project mainly concerns development of software rather than tooling machinery, says Ullrich.

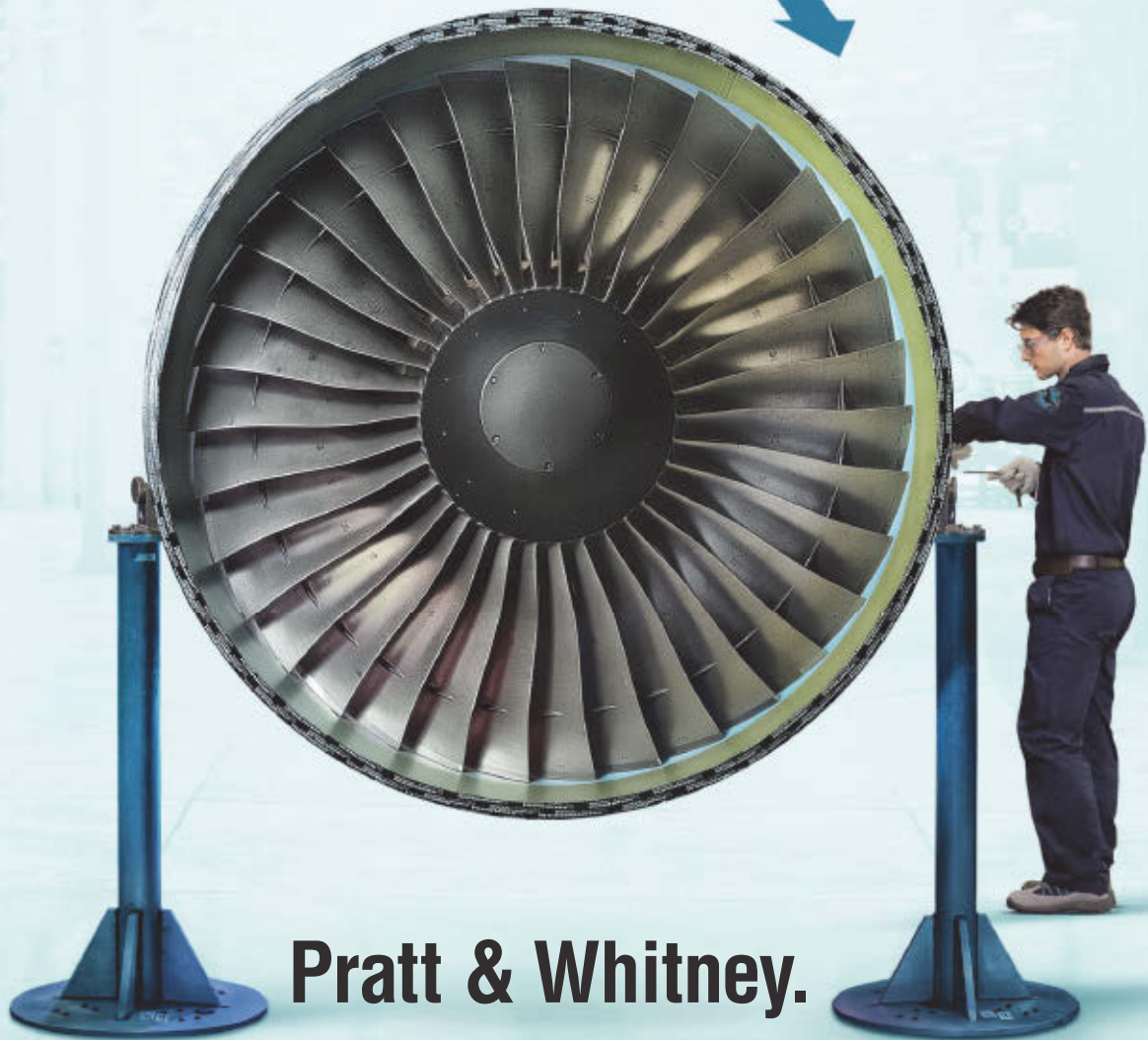
TURNAROUND

While regular aircraft components are still inspected and repaired using traditional manual processes, robots are used as part of an industrial assessment. But the technology promises to reduce average turnaround times for combustor liners from 25 days to 20, says Ullrich.

Other benefits include increased process reliability, 24/7 operation and environmental gains, as the use of dyes for fluorescent penetrant inspections is reduced.

The next stage will include high-pressure compressor casings in the trial, says Ernst. ■

THE SHORTEST DISTANCE BETWEEN YOU AND LOWER COSTS?



Pratt & Whitney.

The shortest distance to profitable operation is your direct line to Pratt & Whitney services. Call us. We respond. With lower costs and uncompromising service. Innovative parts repair instead of replacement, when it's the best option. A broad portfolio of services and innovations, right where – and when – you need them. Take a look at today's Pratt & Whitney services at pw.utc.com/DependableServices. Providing dependable services and customer-focused value.



Dependable Services



Pratt & Whitney
A United Technologies Company

» “Today, if you brought a widebody opportunity to me, the first slot I could offer you is in May,” AAR’s vice-president of sales Troy Jonas told Flightglobal in late February “We are busy right now.”

Jonas declines to name customers, but says they include “large domestic carriers” and Latin American airlines that operate types like 767s, 777s, A330s and A340s.

AAR also sees opportunity for business from airlines based in Southeast Asia, Jonas adds. “We are very bullish on widebodies,” he says. “We expect demand and opportunity to increase.”

AAR is also developing a new MRO site at Chicago Rockford International airport in Illinois, and expects to open the facility sometime in 2016. Demand has been healthy partly because labour costs in Asia have risen in recent years, while at the same time US MRO companies have “done a very admirable job” of improving efficiency, Jonas says.

That trend has benefitted the entire North American industry, having “slowed the multi-year pattern of sending aircraft overseas”, says a 2014 survey from Oliver Wyman.

“North American MROs have an opportunity to repatriate a large share of this widebody work over the coming decade,” adds Team SAI’s report.

AAR’s Jonas says the MRO business has also benefitted because airlines have rushed to upgrade aircraft with newer interiors and modern in-flight entertainment systems.

Other companies have also expanded recently. In February, rapidly-expanding US regional carrier Silver Airways announced it had nearly completed renovations on a 38,000ft² (3,530m²) MRO facility at Orlando International airport. Silver hopes to open the site by the end of March. The airline will use the facility, a former Delta Air Lines and Comair site, to maintain its fleet of 26 Saab 340 turboprops.

OPPORTUNITIES

Maintenance company Aviation Technical Services, which is based in Everett, Washington, has also been expanding, says the company’s senior vice-president of strategy, Gabe Doleac. In 2014 the company opened a former American Airlines facility at Kansas City International airport and acquired repair station Texas Air Composites, Doleac notes. And in 2013 ATS opened an MRO site in Moses Lake, Washington.

In addition, Mobile, Alabama-based VT Mobile Aerospace Engineering, a division of ST Aerospace, signed a 30-year lease in 2014 for MRO space at Pensacola International airport in Florida. As part of the deal, the city is helping to build a hangar, capable of housing two widebodies, on nearly 7.7ha (19 acres) of airport land. Reports say the site will open in 2016.



The North American commercial fleet numbered about 7,300 aircraft in 2014

Also, component supplier AJ Walter Aviation, which has an office in Miami, is looking to expand its offering of aviation services and increase its presence in cities like Chicago and Dallas, the company’s chief technical officer Deepak Sharma tells Flightglobal. The company, based in the UK, significantly increased its North American presence in 2012 with the acquisition of Aveos Fleet Performance in Montreal, which is now called AJW Technique.

“Some opportunities are so good and so big it’s sometimes scary,” Sharma says, adding that AJW seeks to differentiate itself by offering a flexible suite of services that can be “tailor made” to airlines’ requirements.

Another company, Australia-based Thomas Global Systems, has developed a lucrative US business maintaining older cathode ray tube (CRT) displays and replacing CRTs with liquid crystal displays (LCDs), Thomas chief executive Angus Hutchinson tells Flightglobal. CRTs remain in the cockpits of many A320s, MD-80s, MD-11s, classic 737, 757s and 767s, he notes.

The company, which has major international airlines as customers, provides airlines with options if an OEM declares a CRT display obsolete, Hutchinson says. He adds that the FAA’s requirement that airlines upgrade cockpits by 2020 with automatic dependent surveillance-broadcast (ADS-B) systems may also boost demand for CRT upgrades, and low fuel prices could lead airlines to operate older models longer.

MRO executives say their business success largely mirrors airlines’ success, and lower fuel prices have provided lift. They also note that continued low fuel costs could shake up fleet plans, leading airlines to operate some models longer.

“As the price of fuel drops, all of a sudden you can say, ‘We can continue to operate this aircraft profitably, so we may not retire it this

year,’” says Edward Glueckler, secretary general of the Aircraft Fleet Recycling Association. “It’s something the industry is watching.”

Airlines would need more spare parts if they postpone retirements, which could lead some aircraft lessors to break up aircraft for parts – particularly if those aircraft are in low demand and fully depreciated, Glueckler adds. Still, he does not think lower fuel prices will significantly impact disassembly companies, although new players might struggle.

RETIREMENT

“There are still enough airplanes coming out for retirement,” he says. “New entrants may have difficulty because there is not this abundance of aircraft waiting for someone to step forward to dismantle them.”

Medland says fuel prices have reached a level where operating costs of older aircraft have largely reached “parity” with the expense of acquiring and operating newer, more efficient models. “You can continue to fly older aircraft and pay more for the maintenance, which would be good for MRO,” he says.

Doleac agrees. “Lower fuel prices also change the economics of continuing to fly older, less fuel-efficient aircraft,” he says. “These older aircraft have higher maintenance requirements than newer aircraft, hence bolstering the overall demand for MRO services.”

But experts caution that fuel prices remain unpredictable and that airlines have not announced major changes to fleet plans. Jonas at AAR notes that some carriers have recently pressed back into service parked 757s and 767s – decisions that may have been partly influenced by fuel prices.

Still, he cautions against declaring a trend. “I just would not speculate; there are a lot of carriers basing a long-term strategy on the price of fuel,” he says. ■

ADS-B IS COMING. WE COULDN'T WAIT.



Equip Today and Take Advantage of NextGen Now.

NXTSM
800/600
ADS-B XPDR



L-3 offers a diverse line of products and services for airlines. Our transponders were the first certified and available for airliners to meet the global mandates for ADS-B, with installations already complete on hundreds of aircraft. Our new NXT-800™ and NXT-600™ transponders are DO-260B- and DO-181E-compliant to meet ADS-B Out mandates and are optimized for flight in the NextGen/ SESAR air traffic environments. When coupled with L-3's SafeRoute® ADS-B In solutions, they help reduce flight times and fuel consumption, while increasing airspace capacity. We also have Iridium SATCOM to meet upcoming directives in China and other regions, as well as TCAS, TAWS, standby systems, voice and data recorders, displays and aftermarket services.

Update your fleet with L-3 Aviation Products. L-3com.com/AviationProducts.

Aviation Products



L-3com.com

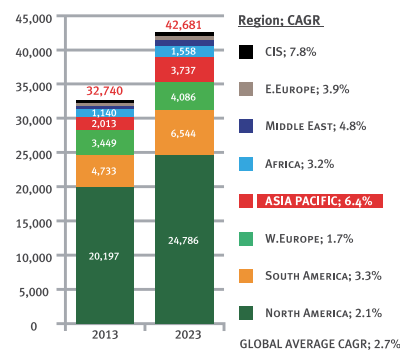
Singapore Airshow gears up to set your sights higher

Singapore Airshow, Asia's largest Airshow and one of the most important aerospace and defence exhibitions in the world, is gearing up for its fifth edition and promises to set your sights higher.

To date, 80% of the 2016 edition has been booked and the event will feature its first Business Aviation Zone, offering exciting new spheres of opportunities for the industry.

According to data from the Federal Aviation Administration, the monthly global business aviation flight movements have started to increase in recent years. Demand is picking up and based on figures by ICF International, the global installed business aviation fleet is forecasted to reach over 42,600 aircraft by 2023, a global compound annual growth rate (CAGR) of 2.7% from 2013.

In Asia Pacific alone, the forecasted CAGR over the 10-year period is more than double this figure at a very optimistic growth rate of 6.4%. Compared



Source: ICF International

to the North American fleet, the Asia Pacific fleet is much younger and smaller.



an **experia** event

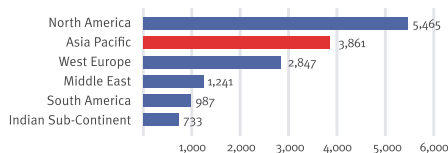
Nonetheless, the industry is sanguine on the growth potential in the Asia Pacific region with the increasing affluence in this region and the liberalisation of the airspace, specifically in China.

Notably, long time exhibitors with the Singapore Airshow such as Bombardier and Cessna have projected strong demand in the long term. Over the next two decades, Bombardier forecasts approximately 1,000 business jet deliveries in Asia Pacific while Cessna has set up a joint service facility with sister company Bell Helicopter at the Seletar Aerospace Park in Singapore to support the South East Asian fleet.

Opportunities abound in the Asia Pacific for Commercial Air Transport

Boosted by recent deliveries to both low cost airlines and national flag carriers, ICF International forecasts that the strong fleet growth in the Asia Pacific region is

TOTAL AIRCRAFT DELIVERIES IN SELECTED REGIONS 2013 - 2023

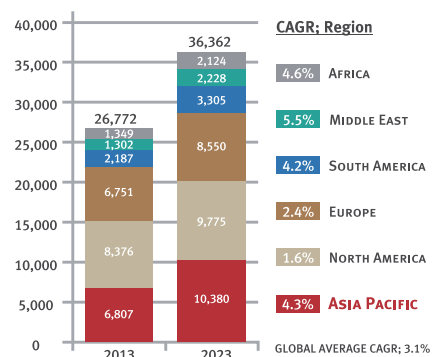


set to continue.

Accounting for new aircraft deliveries and retirements, the installed fleet in Asia Pacific is expected to grow faster at a compound annual growth rate of 4.3%, more than the global average of 3.1%. By 2023, the Asia Pacific airline fleet will have overtaken North America with approximately 10,380 aircraft in service to be the host of the world's largest fleet.

Be part of the Singapore Airshow 2016 and tap directly into the world's fastest growing region.

COMMERCIAL AEROSPACE FLEET GROWTH 2013 - 2023



**CONTACT
OUR SALES
TEAM NOW**

Danny Soong • DID: +65 6595 6123 • E: dannysoong@experiaevents.com
 Vivian Koo • DID: +65 6595 6122 • E: viviankoo@experiaevents.com
 Cathryn Lee • DID: +65 6595 6144 • E: cathrynlee@experiaevents.com



Flightglobal
AVIATION CONNECTED

Flightglobal is proud to support Singapore Airshow 2016
Find us at stand no. P103

For more information on the event,
visit www.singaporeairshow.com
or scan here:





A software algorithm applied to data gleaned from the installed PW4000 fleet has accurately predicted 90% of in-flight shutdowns, P&W says

BIG DATA DAWNING

Supercomputing could transform how P&W engines are monitored and maintained, with information streamed in petabytes and slashing staffing hours by 90 per cent

STEPHEN TRIMBLE HARTFORD

By 2030, tens of thousands of Pratt & Whitney geared turbofans will be generating a staggering amount of data, as well as thrust. The combined fleet will stream 12 petabytes – equivalent to 12 million gigabytes – to servers on the ground every year, with each engine capturing 50 times the amount of data collected by P&W's previous commercial powerplants.

As geared-fan architecture enables a step change in propulsive efficiency, P&W is counting on the power of all that incoming data to drive a substantial improvement in engine reliability. The ultimate result should be a reduction in maintenance costs as the manpower needed to support the fleet declines to one-tenth of staffing levels today.

"On average, it takes 10 people to manage a single engine," says Matthew Bromberg, president of P&W's aftermarket business. "Through analysing data on the engine and providing all the feedback to the customer that's necessary they can go down to a single person."

Capturing the data is the easy part. Each geared turbofan that powers an aircraft built by one of five major manufacturers – Airbus, Bombardier, Embraer, Irkut and Mitsubishi – comes equipped with sensors that capture 5,000 parameters, or 10 gigabytes of data every second. The types of parameters that will be measured include temperatures, air and liquid pressures, rotational speeds and vibrations.

The real challenge is developing a ground-based infrastructure capable of storing, processing and analysing 12 petabytes of information every year. A petabyte is so big a number it

is difficult to conceptualise. As Bromberg grasps for intelligible examples, he sounds like an astronomy professor attempting to analogise the number of stars in a galaxy.

A petabyte is "six times the amount of data stored in all US research institutions today", he says.

PERFORMANCE APPRAISAL

Like any aerospace company, P&W uses data-driven systems to inform design and engineering. Simulation models are used today to predict all aspects of engine performance, including aerodynamics, thermodynamics and structural integrity. The PW4000 also monitors about 100 parameters every second; this data is then used to identify performance and reliability trends. The PW1000G family, however, requires a new level of support, and »

» P&W decided that it needed to look outside for help.

Last July, P&W announced forming a partnership with IBM to begin building the information-processing infrastructure that will be necessary to cope with the geared turbofan fleet's data requirements. IBM has invested \$24 billion recently in data and analytics technology, says Larry Volz, a P&W vice-president and the chief information officer.

"We believe [the IBM partnership] will be an accelerator," Volz says. "They won't be the only folks we use in this journey, and we're already starting to partner with universities and colleges and other companies as well."

Two geared turbofan engines – the PW1100G for the Airbus A320neo and the PW1500G – are scheduled to enter service with customers later this year. The PW1200G for the Mitsubishi Regional Jet and the PW1400G for the Irkut MC-21 are scheduled to complete first flights later this year. The PW1900G and the PW1700G for the Embraer E-190/195 E2 and the E-175 E2, respectively, have now started assembly. As the aircraft programmes ramp up production, each engine will be feeding a continuous stream of performance data that must be stored and analysed.

With IBM's experts now on board, P&W has started building and testing the analytical tools to mine all of that collected information. There are now 14 projects in the demonstration phase, including a key new software algorithm used to predict the most serious engine events.

In P&W's long-term vision, data will be used to detect and prevent uncommanded engine shutdowns. The rate of such events has declined to minuscule levels in modern engines, but P&W believes it can be further halved with the analytical tools already in development.

In laboratory testing, a software algorithm applied to data gleaned from the installed fleet of PW4000 engines accurately predicted 90% of the in-flight shutdowns, Bromberg says.

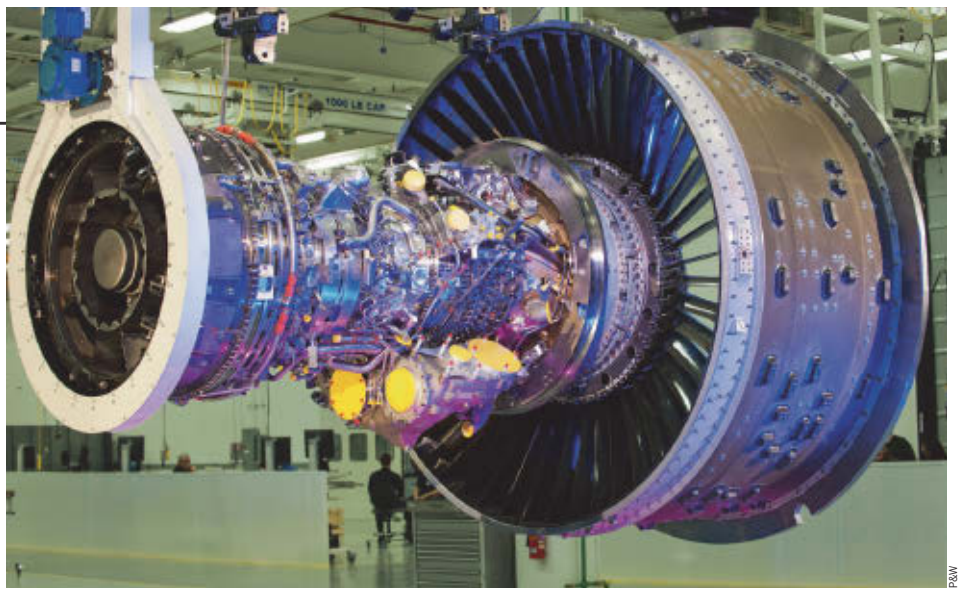
FALSE POSITIVES

The software model is not yet perfect. The software predicts shutdowns, but it also generates false positives when no threat exists, he says.

"Clearly, there's some false positives in there, meaning sometimes it's going to send you an alert on an engine and in fact the parameter is not out of the design space," Bromberg says. "But I can easily see a 50% reduction based on what we see today. A model that is that accurate means we can go in with operators, do on-wing inspection and prevent the event from happening."

P&W plans to make the analytical tool operational on real engines early next year, he adds.

The engine supplier is already in discussions with potential airline customers to define the timing of the alerts, says Lynn Fraga, a P&W analytics manager. "For some of the



The PW1100G is one of two geared turbofans scheduled to enter service later this year

"This is a new technology, new architecture and uncertain maintenance cost"

MATTHEW BROMBERG

President, P&W aftermarket business

maintenance activities you only need a two-day heads-up," she says. "Other things that require more logistics and scheduling you might want a longer timeframe."

These are still early days in the Big Data era for P&W engines. It is arriving just as the overall business model for aftermarket services is changing. The majority of PW2000 and PW4000 engine maintenance services are provided using a transactional model, in which parts and services are provided as customers order them. That is being replaced by a power-by-the-hour service arrangement, in which airlines pay P&W a fee for maintaining a specified availability rate of engines across a customer's fleet.

About 60% of aftermarket service for the V2500 engine fleet has converted to the power-by-the-hour scheme. The rate is even higher for the family of geared turbofan engines, with only one-fifth of engines covered under the older, transactional method, Bromberg says.

Underpinning the new data-driven aftermar-

ket strategy is access to the data. Every power-by-the-hour service deal signed by P&W includes a clause guaranteeing access to the engine performance information, which is owned by the engine buyer. Although 80% of the geared turbofan fleet is covered by such deals, Bromberg says that number is likely to decline as the fleet ages.

DATA SHARING

"This is a new technology, new architecture and uncertain maintenance cost," he says. "As our engine matures, the maintenance cost becomes known, competition develops on the scene – which is good for our customers and for us – and alternatives develop. As the industry matures there will be a variety of maintenance options and it will fragment."

As more service providers enter the market, that does not mean P&W will always lose access to the data streaming off the sensors inside each engine. Most customers using the old transactional service model for engines still freely share the information with P&W, even though there is no contractual requirement to do so.

"Today, the vast majority of airlines share the data with us because they want to perform the business intelligence analytics given current technology and provide the fleet data back on a confidential basis," Bromberg says. "I anticipate going forward the vast majority of customers will be in the same boat."

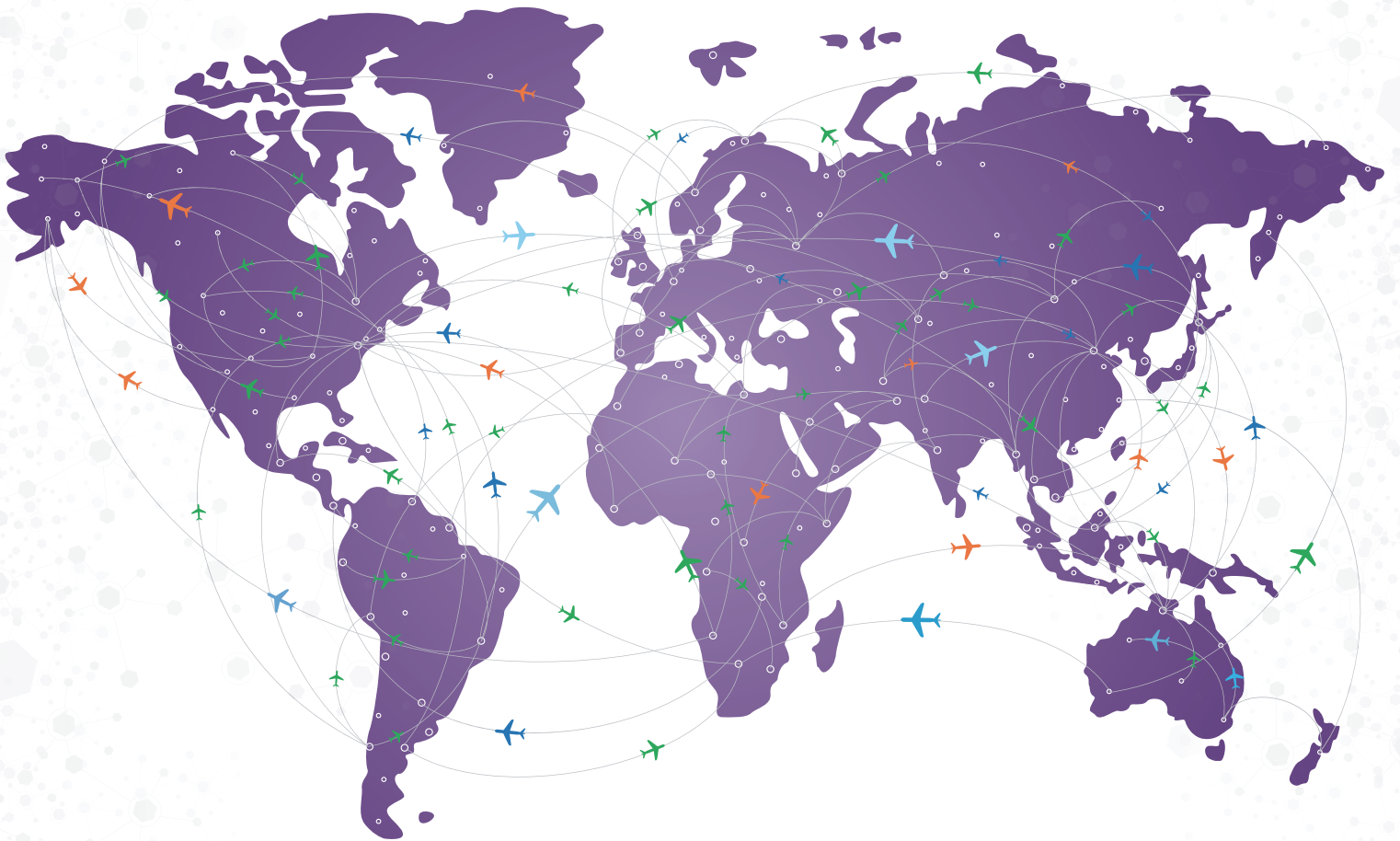
In reality, Bromberg acknowledges, reaching P&W's goal of supporting each engine with only one staff member may be too ambitious. If an airline decides to keep line maintenance and outsource heavy maintenance, for example, that will increase the number of staff required to support the engines, no matter how much data-driven analytics improves the reliability.

"I honestly believe that over the next decade and a half we can drive airlines to a single point of contact within Pratt & Whitney," he says. "I want to have such a comprehensive offering that they are really struggling with how to staff with more than one person because we're going to provide everything to them." ■



Ten staff are needed to service one engine

Where's your next deal?



Connecting the aviation data
and intelligence you need most.

 'Flightglobal'

 @Flightglobal

FLEETS | NETWORKS | SCHEDULES | AIRLINES | AIRPORTS

MID-TWIN TUSSLE

The battle for supremacy in the medium-size widebody category is ratcheting up as Airbus takes the fight to Boeing with its A330neo. But is Toulouse's re-engined family too little, too late?

MAX KINGSLEY-JONES LONDON

Airbus added a dash of spice to the mid-range, mid-size market with last year's launch of an updated version of its best-selling widebody, the A330. But in a sector where there are already several established types, is there enough room for another big twin to be dropped into the mix?

The numbers so far suggest there is. Building off the back of over 1,300 sales of the baseline A330ceo, Airbus has racked up 145 orders and commitments from seven customers for the re-engined, Rolls-Royce Trent 7000-powered A330neo since launching it at last year's Farnborough air show. Not only does this tally put the aircraft well on its way to Airbus's publicly-touted 1,000 aircraft sales target but it also includes several blue-chip customers, including Delta Air Lines and Steve Udvar-Hazy's Air Lease.

The outline definition of the A330neo family is a fairly simple exercise: take today's A330-200 and -300, add the new-generation Trent 7000 engines, some aerodynamic tweaks and a revised interior with "in-

creased cabin efficiency enablers" (to create room for up to 10 more seats), and you end up with the A330-800 and -900, respectively. The latter is the lead variant, to enter service with an as-yet unnamed launch operator in late 2017.

But when scrutinising the details of this warmed-up A330, some could be forgiven for feeling a bit of déjà vu. As Boeing is quick to point out, the A350 started out over a decade ago as an A330-based airframe powered by 787-derived engines until Airbus regrouped and relaunched its assault on the Dreamliner with the all-new A350 XWB family.

A330NEO ORDERBOOK

Customer	-800	-900
Air Lease	–	25
AirAsia	–	55
Avolon Aerospace	–	15
CIT Aerospace	–	15
Delta Air Lines	–	25
Hawaiian Airlines	6	–
TransAsia Airways	4	–
Total	10	135

Firm orders only. SOURCE: Flightglobal's Ascend Fleets database



In 2006, when today's A350 XWB finally crystallised, things looked pretty bleak for Airbus in the widebody sector. The A340-600 was being trounced by the 777-300ER and the A330 was facing a huge threat from the 787 as Boeing rampaged across the globe signing up customers for its all-new twinjet. To make matters worse, Airbus's eventual clean-sheet response, the XWB, was not due to deliver until at least four years after the Dreamliner.

Airbus took a pragmatic approach to its predicament, launching a counter-attack with the A330. The twinjet had at that time been in production for over a decade alongside its sister product, the A340, and between them they had accumulated an installed fleet of over 550 aircraft. So the twinjet had certain attractions of its own, not least of which were price, maturity and good availability.

Airbus's aggressive sales strategy was already paying off when the 787 programme went into meltdown in 2007/08. This not only gave Airbus the breathing space it needed to get the A350 orderbook moving but also added impetus to the A330's renaissance as airlines sought capacity while the Dreamliner

MEDIUM-CAPACITY WIDEBODY COMPARISON

	A330ceo		A330neo		A350 XWB		787	
	-200	-300	-800	-900	-800	-900	-8	-9
Passengers*	246	300	256	310	276	315	242	280
MTOW (t)	242	242	242	242	248	268	228	252.7
Range (nm)	7,250	6,100	7,450	6,200	8,250	7,750	7,845	8,310
List price (\$m)**	229	253.7	249.6	284.6	269.5	304.8	218.3	257.1

*2-class layout for Airbus/3-class for Boeing (Airbus quotes comparative 2-class counts for 787-8 and -9 as 246 and 304) **2015 list price for Airbus, 2014 for Boeing. SOURCE: Manufacturers

Delta chose to order a mix of A330neos and A350s over the 787



Airbus

programme was effectively in limbo.

"[The 787 delays] made the A330 the only airplane available at that time," says Boeing's head of marketing, Randy Tinseth.

STRONG PEDIGREE

Airbus's head of A330 product marketing, Crawford Hamilton, concedes that the twinjet benefited from the Dreamliner's early woes, but is adamant that was only part of the reason for its success. "Undoubtedly, what's gone on with the 787 has not been a hindrance to the A330's success. What that leverages off is the fact that when you buy an A330 you get a product that is very reliable, you know what you are buying and you know when you're going to get it, which is important if you're trying to work out a schedule for next year and then you find out your aircraft might not be coming."

And even with the 787 programme now over its crisis and production ramping up, Hamilton says the current A330 has still been giving a good account of itself.

"The market is split about 50:50 at the moment. The current A330 is around 900-920 aircraft sold against the 787-8 and -9, which has sold 950 to 1,000 aircraft," he says.

But Tinseth, unsurprisingly, is not convinced that the A330 is all that Airbus claims it is cracked up to be: "Look at all the things Airbus has done to try to keep the A330 viable. First they went to a freighter configuration, then they tried to increase the take-off weight, then they tried to sell it as a domestic or regional airplane," he says.

"None of those things were taking hold in



Boeing

"This is the airplane Airbus brought to the market 10 years ago"

RANDY TINSETH

Head of marketing, Boeing

the market so I don't think we're surprised they went forward to re-engine the aircraft and make other improvements."

And Tinseth cannot resist reminding us that Airbus first tried to counter the 787 with a re-engined A330 proposition when Boeing launched the Dreamliner.

"This is the airplane they brought to the market 10 years ago when oil was \$40 a barrel," he says. "And the fact is it didn't do well. When the fuel price was even lower than it is today, airlines looked at the value proposition of the 787 and they chose it. And we think they'll do the same today."

Hamilton is quick to dispel the Boeing his-

tory lesson, pointing out that today's re-engined A330 is very different to the original A330 proposal.

"Our Neo recipe is keeping everything that's good and changing the things where you get the biggest benefits," he says. "It's not an A350 Mk1. That was marked by lots of compromises everywhere. It was restricted by being based on another airplane. It was a good exercise in how not to do it, and we've learnt from that."

Airbus says the changes it is introducing on the A330neo reduce fuel consumption by 14% per seat over the equivalent current A330, as well as providing a range increase of up to 400nm (740km). And the revisions will deliver significant reductions in operating costs.

"Per trip, the A330neo's cash operating costs are 8% lower than the A330ceo and per seat 11% lower, because we have the seat gain [through the cabin reorganisation]," Hamilton says.

COST ADVANTAGE

Airbus claims a significant per-seat cost advantage for the improved models over the 787. Hamilton says the 310-seat A330-900 has cash operating costs 1% lower than a 304-seat (two-class) General Electric GENx-powered 787-9 on a 4,000nm sector and this advantage increases to 7% when all operating expenses are included such as capital or lease charges.

Interestingly, Airbus's 2014 list price for the A330-900 of \$275 million was some \$18 million more than the 787-9, but for the purposes of its operating-cost comparison it assumes that the A330's monthly lease would be \$200,000 lower than the Dreamliner's, at \$1.05 million.

»

» Rob Morris, head of consultancy at Flightglobal's Ascend advisory arm, believes that if Airbus's claims for the A330neo are accurate, it could be onto a winner: "The A330neo should be able to offer direct operating costs which will match or better those of the 787, particularly at the 4,000nm medium range that Airbus is targeting the aircraft at and beneath which the majority of widebody passenger schedules are flown today. If Airbus can deliver such economics in the A330neo then yes, it can challenge the 787 with expectations of market success."

However, Ascend is less bullish than Toulouse on the ultimate market for the re-engined jet. In its 2014 Flightglobal Fleet Forecast, Ascend predicted sales of around 550 A330neos over the next 20 years.

This chimes with Boeing's view, with Tinseth conceding that he sees a modest long-

term requirement for the A330neo: "We see a market for 400-500 airplanes over the next 10-15 years," he says.

Tinseth, however, admits that the re-engining creates a more potent rival for the Dreamliner than the stillborn A350-800 that the Neo has effectively replaced in the Airbus product line-up.

"This is a better airplane than the A350-800, there's no question about it," he says. "That airplane was a simple shrink and didn't have anything going for it."

But this could be a problem for Airbus too, adds Tinseth. "That A330-900 is a bigger airplane than the A350-800. So it not only competes with our airplanes but frankly it's going to steal share from the A350-900 if they price aggressively."

Morris says that some element of the 500 A330neo sales that Ascend forecasts for the A330neo will inevitably come from the A350

market. "An economically optimised medium-range aircraft could potentially be attractive to some airlines that do not have the need for the longer range offered by the A350 XWB and 787. But there was also probably a greater risk that the 787-9 could have captured some sales that may now go to the A330neo."

Hamilton says Airbus broadly sees the two widebody families as appealing to different markets, and emphasises the A350's size and range advantage over the A330.

"The A350-900 is sold on the fact it is a bigger aircraft with more payload and more range," he says, pointing to Delta's order for a mix of A330neos and A350-900s as an example of how the two types are complementary to each other.

"For Delta, where they need the A350-900 is on the Pacific. Where they need the A330 is closer to home. It's a transatlantic aircraft and an aircraft that brings the right mix of economics and capability," says Hamilton.

TRACK RECORD

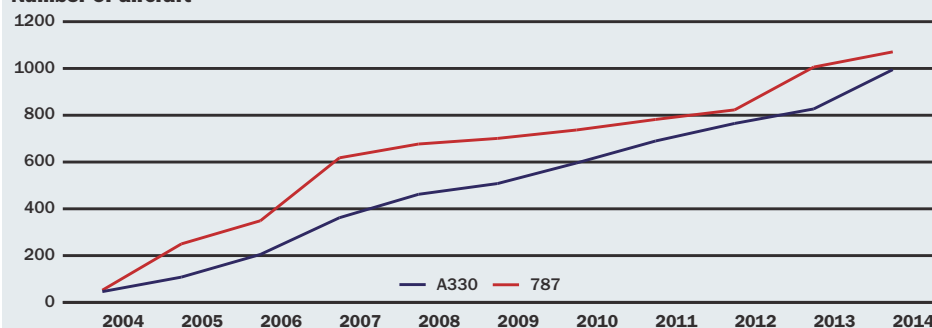
An important factor in Delta's selection of the Airbus package over a 777/787 offering from Seattle was its installed fleet of A330s, and Hamilton says the plan is to use this leverage elsewhere in A330neo campaigns.

"The bedrock of any market is where you already are. With the A330, we've got a record number of operators for a widebody, at around 105-106. That's your prime target because people already know the aircraft very well," says Hamilton.

Air Lease's Udvar-Hazy, who played a key

A330/787 CUMULATIVE ORDERS SINCE 2004

Number of aircraft



SOURCE: Flightglobal's Ascend Fleets database

Note: Annual gross orders. Data for all variants excluding military versions

INTERIORS MAX KINGSLEY-JONES LONDON

SAVING SPACE: CABIN DESIGN TWEAKS CAN SQUEEZE IN 10 MORE SEATS

A SMALL but important component of the A330neo's value proposition is Airbus's project to squeeze up to 10 more passenger seats into the cabin, compared with its current generation equivalents.

With its so-called "increased cabin efficiency enablers", Airbus

aims to "maximise the revenue space between door one and door four by getting more seats without compromising any comfort for the passengers", says Airbus's head of A330 product marketing, Crawford Hamilton.

This project borrows ideas from

a similar effort to boost the seating capacity of the A320 family, using items such as the "smart lav" and "space-flex" toilet concepts. The former is a more optimised lavatory design which occupies less area and therefore provides more space in the cabin.

"This creates a snowball effect of gaining inches here and there to get another row of seats in," says Hamilton.

The space-flex concept involves the relocation of lavatories from the revenue space between door one and four to behind door four, which will in turn help create room for additional seating.

AND THE REST

Another area of focus is the flightcrew rest accommodation, says Hamilton.

"We're looking at taking the flightcrew rest from immediately behind the flightdeck and combining it with the cabin crew rest module in the lower deck," he points out.

"The flightcrew rest behind the cockpit can then be replaced by the galley, so we end up with a net gain in the cabin."

Airbus is studying a crew-rest module with segregated areas for flightcrew and cabin crew, which would occupy the same amount of space as the current cabin crew rest mobile module that can be installed in the A330/A340 rear cargo hold below door three.

The cabin gains depend on each individual cabin product offering, but "overall we've been finding we get up to 10 more seats in most cases", says Hamilton. ■





Air Lease is among the customers for the revamped A330

“The A330-800/900 is quite competitive with the 787-8, particularly in terms of capital cost”

STEVE UDVAR-HAZY

Chief executive, Air Lease

role in launching the A330neo and has orders for 25 -900s, concurs that existing operators are leading candidates: “For an A330/A340 operator, the A330-800/900 is an economical replacement alternative.”

He adds that for an existing Airbus operator, “the A330-800/900 is an effective next step and quite competitive with the 787-8, particularly in terms of capital cost advantage”.

Hamilton says Airbus is also targeting – for both the current version and the Neo – the 777-200 and 767 replacement markets, “and where the competition maybe hasn’t come up to scratch and there’s opportunity. Consistently we’ve been outselling the opposition and therefore we’ll just try and keep that up.”

But one inevitable challenge that Airbus faces before it completes the transition of production to the A330neo is to sell the remain-

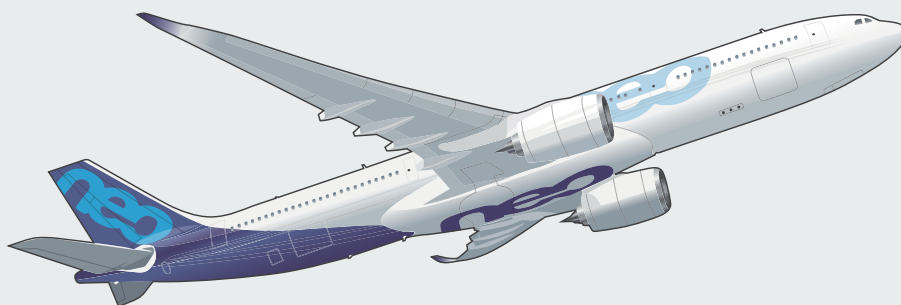
A330NEO KEY FEATURES

Commonality

- A330-800/900neo based on existing A330-200/300
- 95% spares commonality with A330ceo
- Same type rating as A330ceo
- Common type rating as A350 XWB

Cabin developments

- Up to 10 more seats
- Cabin modernisation



Aerodynamic improvements

- New A330 sharklets
- 4% aerodynamic gain from re-optimisation
- Span extension to 64m

New generation engine – Trent 7000

- Increased fan size (from 97.5 to 112in)
- 11% lower fuel burn at Powerplant level
- Latest engine performance improvements

SOURCE: Airbus

ing delivery slots for current-generation models in the production cycle. “They’ve got to figure out a way to fill the A330 line, which looks pretty bleak,” says Tinseth.

Morris believes Airbus still has a “significant number” of A330ceo slots to sell, despite the recent announcement that production will be reduced from the current nine aircraft a month to six in the first quarter of next year. He estimates this move has reduced the target by around 100 units.

“Assuming transition to full Neo production by the end of 2019, then there would appear to be around 300 A330ceo slots remaining to be produced from the beginning of this year,” says Morris.

Ascend estimates that the A330ceo’s true backlog (adjusted for customers such as Kingfisher that will not take their aircraft) is

around 166 units.

“Fourteen aircraft have been delivered to date this year, indicating that 180 of those 300 estimated slots have firm customers. So that still leaves up to 120 aircraft to be sold under this scenario. 2016, 2017 and 2018 look particularly challenging, with an estimated 34, 42 and 36 slots open, respectively,” says Morris.

“In the face of this challenge, Airbus may be forced to offer some serious ‘last-off-the-line’ discounts to encourage customers to purchase these aircraft,” he adds.

So Airbus still has some hurdles to clear as it brings the A330neo to market, but just under a year into the programme will be relatively pleased with its progress so far. What remains to be seen is whether the market really is as big as it predicts. ■

Additional reporting by Laura Mueller

Boeing is confident that customers will be swayed by the 787’s value proposition



GREG WALDRON SINGAPORE

Bull market peaks are often punctuated by landmark transactions. The 2014 Asian Business Aviation Conference & Exhibition (ABACE) saw one such deal, with Minsheng Financial Leasing's jaw-dropping order for 60 Gulfstream private jets, one of the largest orders in the storied manufacturer's history. Bombardier also identified the lessor as the buyer in a late-2013 deal for 10 Challenger 350s.

The buzz at the show, held on an apron adjacent to Shanghai's Hongqiao airport, was palpable. Well-heeled visitors browsed through the cream of the world's business aircraft, enjoying jet makers' hospitality in well-appointed chalets. Still, the overcast conditions shrouded the event, foreshadowing a year in which China's hitherto unstoppable private jet bull market started to run out of steam.

Not to say industry executives have become bears about Asia's biggest market for private jets. Every aircraft manufacturer Flightglobal has spoken to expresses long-term confidence about the market and the real need for business jets as Chinese companies grow at home and expand internationally. Still, they say the market is increasingly characterised by longer decision times, a tougher tax environment, and a glut in the large-cabin arena. Some market observers express concerns about the heavy involvement of Chinese financial firms in the business.

COOLING

Roger Sperry, regional senior vice-president, international sales at Gulfstream, has been doing business in China since 1996. He notes that the market has cooled in the past three to four years. "There has been a decline, but it is still a good market," he says.

Sperry believes the market will remain dominated by large-cabin jets, but that there will be increasing interest in midsize types such as the G280, which can carry 10 passengers up to 3,600nm (6,670km), making routes such as Beijing-Singapore possible.

"Smaller companies are also likely to start looking at jets, but they will go mid-sized as they can't afford a G450 and higher," he adds. Furthermore, some customers are starting to use private jets to ferry around not just the chairman, but middle to senior-level executives. This shows that Chinese firms are recognising that private aircraft are, indeed, business tools, rather than a status symbol for the boss.

At Gulfstream's rival, Dassault Falcon, China general manager Jean Michel Jacob also notes a distinct cooling in the market, but he too remains optimistic.



IS CHINA FEELING THE CHILL?

Indicators point to a business jet slowdown in the world's second-largest economy, but manufacturers are optimistic about the longer term outlook

"The market has slowed down, yes," says Jacob. "It might be a temporary slowdown as we need to face some political issues over which we have no control, and we have to face the fact that people have bought many business jets over the last 10 years, and now they have to digest that. China still needs business jets for the development of the economy. In the long run, we have to remain positive and optimistic. We will still

invest in making our brand known."

Embraer has also noticed a distinct tightening, with deliveries and new orders declining in 2014. Apart from China's slowing economy, the Brazilian jet maker also sees other constraints, such as parking spaces, and a lack of pilots, as well as fast-growing commercial airlines that compete for scant airport and airspace resources.

The airframer, too, notices a maturing



The overcast conditions in Shanghai for ABACE 2014 were perhaps apt for what was to follow

Greg Walborn/Flightglobal



Greg Walborn/Flightglobal

Few expect big orders this year

trend, and believes that midsize jets, such as its Legacy 500 offering, will see growing interest within the country.

“Chinese customers have been more focused on the large-cabin aircraft, but in the past 12 months, purchases have tended to be more mature and focused on real usage instead of just huge cabins and long range,” says an Embraer spokeswoman.

Asian Sky Group, a Hong Kong-based con-

sulting firm, used last year’s ABACE to launch a report about the greater China business jet fleet in 2013. It plans to use ABACE to launch a revised version for 2014. In 2013, it put the number of business jets operating in Greater China – Mainland China, Hong Kong, Taiwan, and Macau – at 371 aircraft.

The two most popular models in the region are the G550 and G450, representing 30% of Greater China’s total fleet.

Another trend Asian Sky observed was an increased willingness on the part of Chinese buyers to acquire used aircraft. In 2013, 47% of the aircraft delivered into the China market were pre-owned, with the remaining 53% being new aircraft.

Asian Sky’s general manager, Jeffrey Lowe, corroborates the view that the market is slowing. He contends that more private jets actually left China in 2014 than entered the market. He cites three key reasons for the slowdown. The first is a tougher tax environment that makes it harder for jet owners to avoid duties and value-added tax, which can come to about 23-24% of an aircraft’s value or lease rate.

In years past, a favourite tactic was to set up an offshore structure to own a private jet, which was then leased to the user at an extremely low rate. Chinese officials, previously oblivious to the actual costs involved in jet ownership and usage, have become more sophisticated. They now possess a better sense of lease rates as defined by the aircraft’s overall value, and are willing to take jet owners and operators to task.

AUSTERITY

“Some Chinese owners facing a higher tax burden are changing the country of registration of their aircraft and then basing them offshore,” says Lowe. “This will cause some additional hurdles that owners will have to jump over when operating the aircraft back in China (as they are no longer domestically registered), but a good management company can help facilitate this.”

The other two factors Lowe points to for a slowing market are a general austerity campaign – a major element of which is the rooting out of corruption – and slower economic growth. Some high fliers simply cannot afford a private jet anymore.

Another area of concern, according to several people involved in China’s private jet market, is the prevalence of leasing firms. Flightglobal’s Ascend Fleets database shows that Minsheng manages 84 in-service private jets, most of which are leased out to local private jet operators, many of which are units of Chinese airlines.

Other prominent financial firms with aircraft leasing arms engaged in the private jet business are the Industrial and Commercial

Bank of China (ICBC), Bank of Communications, and the Agricultural Bank of China.

“In China we have a very specific situation where financial institutions buy aircraft and then sell or lease them to other people,” says one industry executive.

“They thought they would control the market, but I’m not sure it’s a total success. The model is based on the assumption that the original equipment manufacturers will give away their marketing, and that the OEMs will offer them big discounts, essentially financing the aircraft until they are leased. This business model might succeed, but it might not.”

The executive says a key element of the model is predicated on the leasing firms’ belief that they have sufficient market connections to move aircraft.

RISKY

“Imagine an OEM sells 10 or 20 aircraft to one of those banks, but then they decide not to take title?” he asks. “It’s always a risky business. You think you have a nice orderbook, but it’s very fragile, in fact.”

Asian Sky’s Lowe expects that the current economic environment will make it a hard slog for financial firms to move private jets, especially in light of the massive influx in jets during the past few years.

“This has led to an oversupply of new-build aircraft available in the Chinese market, which could also lead to a conflict with the OEMs, as they are both pursuing the same market,” he says. “It is firmly a buyer’s market in China these days, as there are a large number of aircraft on the orderbooks chasing a small market of buyers.”

Ascend shows firm orders for 48 aircraft for business usage in China, most of which are due for the delivery in 2015. These include eight Bombardier Global Express 6000s and 18 Challengers, eight Embraer ERJ-135s and two E-190s. Of the 48 orders, 17 are going to Minsheng, and five each to ICBC, CDB Leasing, and CIB Leasing.

Gulfstream’s 60-aircraft deal with Minsheng is not included among these 48 orders, however, because it has not disclosed details of the deal, such as the number of firm orders, number of options, and delivery timeframes. A Gulfstream spokesman says the deal is on track and that the first jet will be delivered, as planned, in 2015.

This year’s ABACE promises to be another major private jet event, with all the key manufacturers bringing their best aircraft to the show. Even though few industry observers expect big, landmark orders, they all remain optimistic about China’s long-term prospects. Every market goes through the odd trough, they say, before eventually rising to new highs. ■

FLIGHT INTERNATIONAL

We welcome your letters on any aspect of the aerospace industry.

Please write to: The Editor, Flight International, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS, UK. Or email flight.international@flightglobal.com

The opinions on this page do not necessarily represent those of the editor. Letters without a full postal address supplied may not be published. Letters may also be published on flightglobal.com and must be no longer than 250 words.

Don't accidents in Africa matter?

From the beginning of our aviation careers, when we talked about aircraft investigations we were told one of the reasons they were conducted was to prevent future accidents from occurring for the same reasons – or close to the same reasons – to the incident that is being investigated.

But regarding the initial results on the investigation of the Germanwings tragedy, I wonder if that's the case. In the past couple of years we had two similar situations with African carriers: LAM E190 in November 2013 with 34 deaths, and the Ethiopian Boeing 767 in February 2014, with no fatalities.

Judging by the media coverage in both general publications and specialised media like this magazine, no recommendations were made to avoid situations like this happening again.

Now there has been an accident involving a European low-cost carrier, and suddenly we start to change procedures to avoid a repeat. Are African carriers' accidents less important than European ones?

CABIN AIR CONTAMINATION

BALPA took lead on toxic fumes

Regarding the letter from Philip Flower entitled "Toxic problem ignored for too long" (*Flight International*, 10-16 March): it is not true to say that "The IPA is the only trade union for pilots actively examining this problem."

The British Airline Pilots Association (BALPA) initiated the process that led to the Committee on Toxicity inquiry and the subsequent Department for Transport-sponsored research into the matter.

Currently we are establishing a protocol for the medical management of affected pilots. We encourage concerned pilots in the UK to see their family doctor and if necessary they can be referred to the National Health Service's clinical toxicology service.

"Aerotoxic syndrome" has been described as consisting of a variety of symptoms – such as tiredness, headache and coughing – that are otherwise very common, not only as symptoms of minor problems but rarely also as symptoms of a range of more serious illnesses, not just poisoning.

We feel it is particularly important that pilots are seen by registered specialists that have a known capability to assess conditions within their field and to appropriately refer on cases to other medical specialities.

The problem is that jet engine bleed air can become contaminated with heated engine oil if oil leaks into the compressor stage of the engine. In principle, any system of cabin air supply that compresses air causing its temperature to rise may have similar vulnerabilities.

Dr Robert Hunter

Head of flight safety, BALPA
West Drayton, UK

If after the LAM crash the same measures that are being put in place today had been established we would, probably, not now be mourning the 150 lives lost in the French Alps.

Igor Lelis

By email

Security flaws

The Germanwings incident serves to demonstrate the waste of resources and lack of respect for pilots involved in carrying out security checks on flight-crews. As an airline captain I have been asked to remove my shoes many times.

How wrong has it been to install reinforced cockpit doors? To

protect the pilots from the passengers? And who protects the passengers from the pilots?

There is no civil aviation if pilots cannot be trusted. We have let stupidity storm civil aviation. It's time to start thinking again.

Valerio Viola

By email

Had the doctors who were treating the co-pilot informed the airline of his condition, this accident could have been avoided. I understand the confidentiality of the doctor-patient relationship, but where the patient has the lives of hundreds of people in his hands, there has to be an exception.

Rodolfo A Serna

Bogota, Colombia

I am intrigued by the inability to open the cockpit door.

I had a look at the requirements and found that FAR(JAR/CS) 25.772(c) states that:

There must be an emergency means to enable a crewmember to enter the pilot compartment in the event that the flight crew becomes incapacitated.

How is it that this did not work in the Germanwings incident? The MMEL [master minimum equipment list] allows the cockpit door surveillance system to be inoperative provided it is deactivated.

Charles Aufranc

Mont-sur-Rolle, Switzerland

Three's company

Recent events have highlighted problems that have been solved in the past.

Firstly, heated engine oil getting into cabin air and causing health problems, and secondly a pilot left alone on the flightdeck and failing to act correctly – to put it mildly.

Back in the 1960s the Vickers VC-10 solved both problems.

All the air entering the cabin did not come from the engines. A separate intake, between the engine intakes, provided air to separate compressors mounted on top of the engines – not part of the engine, but driven by the engine. The lubricant could be chosen to avoid health problems.

The flightdeck crew was three: a captain, a co-pilot and a flight engineer. So any one could leave the flight deck and leave two minding the shop.

The VC-10 also had a crew toilet on the flightdeck, so it was not even necessary to leave the flightdeck for a leak.

Ian Kirby

Former flight engineer, VC-10
Ashford, UK



Build your career

Try Flightglobal Training's new site for the fastest route to building your aerospace and aviation career

FG Flightglobal Training

Training courses to take you there
www.flightglobal.com/training

EDITORIAL, ADVERTISING, PRODUCTION & READER CONTACTS

EDITORIAL +44 20 8652 3842

**Quadrant House, The Quadrant,
Sutton, Surrey, SM2 5AS, UK**
flight.international@flightglobal.com

Editor Murdo Morrison FRAeS
+44 20 8652 4395 murdo.morrison@flightglobal.com
**Head of Strategic Content/
Flight Daily News Editor** Dominic Perry
+44 20 8652 3206 dominic.perry@flightglobal.com
Managing Editor/Defence Editor Craig Hoyle
+44 20 8652 3834 craig.hoyle@flightglobal.com
Business Editor Dan Thisdell
+44 20 8652 4491 dan.thisdell@flightglobal.com
Operations/Safety Editor David Learmount
+44 20 8652 3845 david.learmount@flightglobal.com
Business & General Aviation Editor Kate Sarsfield
+44 20 8652 3885 kate.sarsfield@flightglobal.com
Aerospace and Defence Reporter Beth Stevenson
+44 20 8652 4382 beth.stevenson@flightglobal.com
Magazine Enquiries Dawn Hartwell
+44 20 8652 3315 dawn.hartwell@flightglobal.com

AIR TRANSPORT TEAM

Editor Flightglobal Premium News Graham Dunn
+44 20 8652 4995 graham.dunn@flightglobal.com
Managing Editor Niall O'Keefe
+44 20 8652 4007 niall.okeefe@flightglobal.com
Air Transport Editor David Kaminski-Morrow
+44 20 8652 3909
david.kaminski-morrow@flightglobal.com
Air Transport/MRO Reporter Michael Gubisch
+44 20 8652 8747 michael.gubisch@flightglobal.com
Senior Reporter Oliver Clark
+44 20 8652 8534 oliver.clark@flightglobal.com

AMERICAS

Americas Managing Editor Stephen Trimble
+1 703 836 8052 stephen.trimble@flightglobal.com
Deputy Americas Editor - Air Transport Ghim-Lay Yeo
+1 703 836 9474 ghimlay.yeo@flightglobal.com
Air Transport Reporter Edward Russell
+1 703 836 1897 edward.russell@flightglobal.com
Air Transport Reporter Jon Hemmerdinger
+1 703 836 3084 jon.hemmerdinger@flightglobal.com

ASIA/PACIFIC

Asia Editor Greg Waldron
+65 6780 4314 greg.waldron@flightglobal.com
Asia Air Transport Editor Mavis Toh
+65 6780 4309 mavis.toh@flightglobal.com
Asia Finance Editor Ellis Taylor
+65 6780 4307 ellis.taylor@flightglobal.com
Reporter Aaron Chong
+65 6780 4851 aaron.chong@flightglobal.com

EUROPE/MIDDLE EAST

Israel Correspondent Arie Egozi
Russia Correspondent Vladimir Karnozov

FLIGHTGLOBAL.COM

Editor Stuart Clarke
+44 20 8652 3835 stuart.clarke@flightglobal.com
Web co-ordinator Rebecca Springate
+44 20 8652 4641
rebecca.springate@flightglobal.com

EDITORIAL PRODUCTION

Head of Design & Production Alexis Rendell
Global Chief Copy Editor Lewis Harper
Chief Copy Editor, Europe Dan Bloch
Layout Copy Editors Sophia Huang,
Tim Norman, George Norton
Global Production Editor Louise Murrell
Deputy Global Production Editor Rachel Warner
Deputy Digital Producer Damion Diplock
Digital Production Editor Colin Miller
Web Production Editor Andrew Costerton
Senior Designer Lauren Mills
Consulting Technical Artist Tim Hall

DISPLAY ADVERTISEMENT SALES

**Quadrant House, The Quadrant,
Sutton, Surrey, SM2 5AS, UK**

EUROPE

Sales Manager Shawn Buck
+44 20 8652 4998 shawn.buck@flightglobal.com
Key Account Manager Grace Hewitt
+44 20 8652 3469 grace.hewitt@flightglobal.com
Sales Support Gillian Cumming
+44 20 8652 8837 gillian.cumming@rbi.co.uk

NORTH & SOUTH AMERICA

Vice-President, North & South America
Rob Hancock +1 703 836 7444
robert.hancock@flightglobal.com
Regional Sales Director
Warren McEwan +1 703 836 3719
warren.mcewan@flightglobal.com
Sales Executive Kaye Woody
+1 703 836 7445 kaye.woody@flightglobal.com
Reed Business Information, 333 N. Fairfax Street,
Suite 301, Alexandria, VA 22314, USA

ITALY

Sales Manager Riccardo Laureri
+39 (02) 236 2500 media@laurerassociates.it
Laureri Associates SRL, Via Vallazze 43,
20131 Milano, Italy

ISRAEL

Sales Executive Asa Talbar +972 77 562 1900
Fax: +972 77 562 1903 talbar@talbar.co.il
Talbar Media, 41 HaGiva'a St, PO Box 3184, Givat
Ada 37808, Israel

ASIA/AUSTRALASIA

Key Account Manager Jay Ee
+65 6780 4301 jay.ee@flightglobal.com
Fax: +65 6789 7575
1 Changi Business Park Crescent,
#06-01 Plaza 8 @ CBP, Singapore 486025

RUSSIA & CIS

Director Arkady Komarov
komarov@worldbusinessmedia.ru
Tel/Fax: +7 (495) 987 3800
World Business Media, Leninskoy Prospekt, 80,
Korpus G, Office 807, Moscow 125190, Russia

CLASSIFIED & RECRUITMENT

Sales Manager Sophie Wild
sophie.wild@rbi.co.uk
**Recruitment & Classified Key Account
Executive** Katie Mann
+44 20 8652 4900
Recruitment.services@rbi.co.uk
Recruitment & Classified Sales Executive
Stuart Lee +44 20 8652 4900
Classified.services@rbi.co.uk
Key Account Manager - Asia Jay Ee
+65 6780 4301

ADVERTISEMENT PRODUCTION

Production Manager Sean Behan
+44 20 8652 8232 sean.behan@rbi.co.uk
Production Manager Classified Alan Blagrove
+44 20 8652 4406 alan.blagrove@rbi.co.uk

MARKETING

Marketing Director Justine Gillen
+44 20 8652 8031 justine.gillen@flightglobal.com

DATA TEAM

Head of Data Pete Webber
+44 20 8564 6715
peter.webber@flightglobal.com
Commercial Aviation Steven Phipps
+44 20 8564 6797
steven.phipps@flightglobal.com
Defence & GA John Maloney
+44 20 8564 6704
john.maloney@flightglobal.com

PUBLISHING MANAGEMENT

Chief Operating Officer
Philippa Edward
Executive Director Content
Max Kingsley-Jones
max.kingsley.jones@flightglobal.com
Publisher Stuart Burgess
stuart.burgess@flightglobal.com

READER SERVICES

Subscriptions

Jenny Smith
Flight International
Subscriptions, Reed Business Information,
PO Box 302, Haywards Heath,
West Sussex, RH16 3DH, UK



Subscription Enquiries

+44 1444 475682
Fax +44 1444 445301
flightinternational.subs@quadrantsubs.com

Subscription Rates

1 Year: £141/\$225/€174
2 Years: £239.70/\$382.50/€295.80
3 Years: £338.40/\$540/€417.60
Only paid subscriptions available. Cheques
payable to Flight International

Flight International welcomes unsolicited contributions
from readers but cannot guarantee to return
photographs safely.

© and Database Rights 2015 Reed Business Information
Ltd. All rights reserved. No part of this publication may be
reproduced, stored in a retrieval system or transmitted in
any form or by any means, electronic, mechanical,
photocopying, recording or otherwise, without the prior
permission in writing of the publishers.



Ascend, a Flightglobal
advisory service, is a leading
provider of expert advisory
and valuations services to
the global aviation industry. Its specialist, independent
services inform and shape the strategies of aviation
businesses worldwide. Ascend offers an unrivalled
breadth and depth of aviation expertise and experience,
backed by unique access to robust industry data.
www.ascendworldwide.com Tel: +44 20 8564 6700
email: consultancy@ascendworldwide.com

FG dashboard

Flightglobal's dashboard is a paid-for news and data
service for professionals who need to find new
opportunities or track competition within the air transport
industry. The service puts a wealth of global intelligence at
your fingertips, covering everything from airline fleets,
routes and traffic, through to aircraft finance, industry
regulation and more. **www.flightglobal.com/dashboard**

FG Flightglobal Insight

Flightglobal Insight provides a range of tailored research
reports and analysis, with access to information and
industry expertise from the unrivalled Flightglobal Premium
services portfolio. **www.flightglobal.com/insight**
Tel: +44 20 8652 3914 email: insight@flightglobal.com

Registered at the Post Office as a newspaper.
Published by Reed Business Information Ltd, Quadrant
House, The Quadrant, Sutton, Surrey SM2 5AS, UK.
Tel: +44 20 8652 3500.

Newstrade distributed by Marketforce (UK) Ltd, Blue Fin
Building, 110 Southwark Street, London SE1 0SU, UK.
Tel: +44 20 3148 3300.

Classified advertising prepress by CCM.
Printed in Great Britain by William Gibbons and Sons Ltd.

Flight International published weekly 49 issues per year.
Periodicals postage paid at Rahway, NJ. Postmaster send
changes to Reed Business Information, c/o Mercury
International Ltd, 365 Blair Road, Avenel, NJ 07001

This periodical is sold subject to the following conditions:
namely that it is not, without the written consent of the
publishers first given, lent, re-sold, hired out or in any
unauthorised cover by way of trade, or affixed to, or as
part of, any publication of advertising, literary or pictorial
matter whatsoever. No part of the content may be stored
electronically, or reproduced or transmitted in any form
without the written permission of the Publisher.

ISSN 0015-3710

Part of rbi reed business
information



EVENTS

20-21 April

ISR conference
Holiday Inn Regent's Park, London
isrconference.com

20-23 April

AeroDef Manufacturing
Hilton Anatole, Dallas
aerodefevent.com

24 April

Skytech
Business Design Centre, London
skytechevent.com

29-30 April

Loyalty@Freddie Awards
Atlanta, USA
flightglobalevents.com/
loyaltyfreddies2015

1-3 May

Drones, Data X conference
Santa Cruz, California
nua.io

4-7 May

AUVSI's Unmanned Systems
Atlanta, USA
auvshow.org

10-11 May

Aviation Africa
Dubai, UAE
aviationafrica.aero

13-14 May

Ascend Asia: Finance Forum
Singapore
flightglobalevents.com/ascendasia2015

17-20 May

ALTA CCMA
Punta Cana, Dominican Republic
alta.aero/ccma

19-21 May

EBACE
Geneva, Switzerland
ebace.aero/2015

26-28 May

AP&M Europe
Olympia London, UK
apmexpo.com

31 May - 3 June

**1st International Symposium on
Sustainable Aviation (ISSA)**
Istanbul, Turkey
issasci.org

4-6 June

France Air Expo
Lyon-Bron airport, France
franceairexpo.com

15-21 June

Paris Air Show
Le Bourget, Paris
siae.fr

30 June

Ascend Europe: Finance Forum
London
flightglobalevents.com/
ascendeurope2015

17-19 July

Royal International Air Tattoo
RAF Fairford, Gloucestershire, UK
airtattoo.com

18-20 September

Midden-Zeeland airport fly-in
Arnhem, the Netherlands
neeland-airport.nl



For a full list of events see
flightglobal.com/events

CLASSIFIED

TEL +44 (0) 20 8652 4897 **FAX** +44 (0) 20 8652 3779 **EMAIL** classified.services@rbi.co.uk

Calls may be monitored for training purposes

New and used aircraft

2012 CESSNA CITATION XLS+

Gulfstream®

Independent Authorised Sales Representative for the United Kingdom

Tim Leacock
AIRCRAFT SALES LIMITED

+44 (0) 1258 818181 tim@timleacockaircraft.com jonathan@timleacockaircraft.com

timleacockaircraft.com

Courses and tuition



SE-ATO-003.

TYPE RATINGS INCLUDING AIRCRAFT TRAINING ON:

**ATR 42/72-500, SAAB 2000,
SAAB 340, AVRO RJ and ATP.**

New courses started continuously. For more information contact us on info@braathenstraining.com or visit BraathensTraining.com

General

PILOTS

RETIREMENT & SAVINGS CONCERNS?

Our 15 year investment programme has an average annual return of 8.5% with a guaranteed minimum.

To find out more visit crewinvest.net or contact us on info@crewinvest.net

info@crewinvest.net
www.crewinvest.net

CrewInvest

Business services

air support

alpine

Dauphin AS.365
Parts Specialists
www.alpine.aero
Tel: +41 52 345 3605

FLIGHT INTERNATIONAL

To advertise in this classified section:

call +44 (0) 20 8652 4897

fax +44 (0) 20 8652 3779

email classified.services@rbi.co.uk

Please note that calls may be monitored for training purposes

AJW



Transforming aviation efficiency

The AJW Group is a multi-faceted organisation and a world leading specialist in the supply, exchange, repair and lease of commercial aircraft spare parts.

With a focus on quality that permeates every aspect of the business and the customer experience, AJW is justifiably proud of the reputation it has built for providing the resources, in terms of expertise and inventory, which support more than 1,000 airlines in 115 countries.

AJW Aviation's services include: parts sales, loans and exchanges; power-by-the-hour and pool access; consignment stock; aircraft engines; consumable supplies; global 24/7 AOG; repair and inventory management; parting-out; logistics and door-to-door freight management.

AJW is highly regarded for its 24/7 AOG and critical response service excellence and its ability to provide guaranteed delivery from a significant core inventory of Airbus and Boeing aircraft spares, comprising over 450,000 line items valued at nearly US\$500m.

AJW Technique utilises one of the best industry-specific engineering skill bases in the world to provide a broad range of component repair and overhaul services for the AJW repair supply chain. This is focused on delivering world class reliability, first class turn times, minimised AOG costs and superior warranties.

AJW Engines' significant aircraft engine portfolio offers integrated management solutions providing engineering services, aircraft engines for lease, and quality overhauled condition engine material can assist operators to minimise engine maintenance costs.

AJW Leasing and **AJW Capital Partners** provide complementary and sophisticated financial solutions for a wide range of aviation projects on a global scale. By accessing these highly professional services, airlines and operators can benefit from a different perspective, and the commercial wisdom that draws on the Group's capabilities and expertise which has been honed across decades of aviation experience.

ajw-group.com

AJW aviation

AJW technique

AJW engines

AJW capital

AJW leasing

Please visit us: Stand 1010, MRO Americas 2015, 14-16 April, Miami

Tenders



HEAD OFFICE, BALAKA, KURMITOLA, DHAKA-1229, BANGLADESH
PHONE: 8901600-14, 8901680-94, FAX: 88-02-8901558, www.biman-airlines.com
Ref: DACPM/737-800/154/2015/1456 Date: 19 February 2015

Request for Proposal (RFP) for dry lease of one 737-800 aircraft

1. Biman Bangladesh Airlines Ltd. invites Proposal/Offer for taking of 01 (one) 737-800 aircraft for a period of 60 (sixty) months on dry lease basis. Airlines, Operators, Owners of Aircraft, Manufacturers, Leasing Companies having aircraft of its own or legally authorized by the owner may participate in the RFP complying with the terms & conditions given in the RFP Schedule. Basic requirements are mentioned below:

a. Number and Type of Aircraft	01 (one) 737-800 aircraft.
b. Seat Configuration	Two class configuration with 162 (12J+150Y) seats. All seats shall have to be in good condition.
c. Age of the Aircraft	The aircraft should not be more than 10 years of age as on closing date of RFP.
d. Nature and period of Lease	Dry Lease for a period of 60 (sixty) months.
e. Commencement of Lease	July 2015.
f. Representation & Authorization	If the Bidder/Lessor is not the owner of the aircraft, then owner's authorization/ mandate must be submitted prior to negotiation.

2. Detailed information is available in the RFP Schedule. RFP Notice and Schedule may be viewed at Biman's website: www.biman-airlines.com .
3. The Proposal/Offer may be submitted to the General Manager (Corporate Planning) at E-mail: dacpm154@bdbiman.com by 1000 hours LT (0400 hrs UTC) on 16 March 2015. Proposal/Offer may also be submitted through Courier Service or dropped in the Box placed in the Office of the General Manager (Corporate Planning), Biman Head Office, Balaka, Kurmitola, Dhaka-1229 within the stipulated time. The Proposal(s)/Offer(s) will be opened immediately after the closing time in presence of the Bidder(s), if any. No Proposal/Offer would be accepted after the closing time. Biman Bangladesh Airlines Ltd. will not be responsible for late receipt of Proposal/Offer due to any reason, whatsoever.
4. For further information or query, General Manager (Corporate Planning) may be contacted at Telephone: +880-2-8901600/Extension-2415, +880-2-8901697 (direct), Fax: +880-2-8901396, E-mail: gmp@bdbiman.com during the office hours.
5. Biman Bangladesh Airlines Ltd. reserves the right to accept or reject any or all the Proposals/Offer at any time and/or stage without assigning any reason, whatsoever, and no claim will be entertained in this regard.

Mohd. Abdur Rahman Faruky
General Manager Corporate Planning (Acting)



HEAD OFFICE, BALAKA, KURMITOLA, DHAKA-1229, BANGLADESH
PHONE: 8901600-14, 8901680-94, FAX: 88-02-8901558, www.biman-airlines.com
Ref: DACPM/777-300ER/155/2015/1461 Date: 24 February 2015

Request for Proposal (RFP) for Dry Lease of one 777-300ER Aircraft

1. Biman Bangladesh Airlines Ltd. invites offers/proposals for Dry Lease of 01 (one) 777-300ER aircraft for a period of 60 (sixty) months. Airlines, Operators, Owners of Aircraft, Manufacturers, Leasing Companies having aircraft of its own or legally authorized by the owner to submit the offer, may participate in the RFP complying with the terms & conditions stated in the RFP schedule. Basic requirements are mentioned below:

i. Number and Type of Aircraft	01 (one) 777-300ER aircraft.
ii. Nature & Period of Lease	Dry Lease for 60 (sixty) months.
iii. Configuration	Two class configuration not less than 419 seats. All seats shall have to be in good condition.
iv. Age of the Aircraft	The aircraft should not be more than 10 years of age as on closing date of RFP.
v. Authorization	If the lessor is not the owner of the aircraft, owner's authorization/mandate must be submitted prior to negotiation.
vi. Commencement of Lease	July 2015

2. Detailed terms and conditions have been given in the RFP schedule. RFP notice and schedule may be viewed in Biman's web-site: www.biman-airlines.com .
3. The Offers/Proposals are to be submitted latest by 1000 hours LT (0400 hrs UTC) 19 March 2015 addressed to General Manager (Corporate Planning), Biman Bangladesh Airlines Ltd., Head Office, Balaka, Dhaka, Bangladesh through E-mail at dacpm155@bdbiman.com. Proposals/offers may also be submitted through courier service or dropped in the Tender Box placed in the office of General Manager (Corporate Planning), Biman Head Office, Balaka, Kurmitola, Dhaka-1229. No offer/proposal will be accepted after the closing time and date.
4. For further information or query, General Manager (Corporate Planning) may be contacted at Telephone: +880-2-8901600/Extension-2415, +880-2-8901697 (direct), Fax: +880-2-8901396, E-mail: gmp@bdbiman.com during the office hours.
5. Biman Bangladesh Airlines Ltd. reserves the right to accept or reject any or all the offers/proposals partly or wholly without assigning any reason whatsoever and no claim shall be entertained in this regard.

Mohd. Abdur Rahman Faruky
General Manager Corporate Planning (Acting)



HEAD OFFICE, BALAKA, KURMITOLA, DHAKA-1229, BANGLADESH
PHONE: 8901600-14, 8901680-94, FAX: 88-02-8901558, www.biman-airlines.com
Ref: DACPM/777-200ER/153/2015/1455 Date: 19 February 2015

Request for Proposal (RFP) for Dry Lease of one 777-200ER Aircraft

1. Biman Bangladesh Airlines Ltd. invites offers/proposals for Dry Lease of 01 (one) 777-200ER aircraft for a period of 60 (sixty) months. Airlines, Operators, Owners of Aircraft, Manufacturers, Leasing Companies having aircraft of its own or legally authorized by the owner to submit the offer, may participate in the RFP complying with the terms & conditions stated in the RFP schedule. Basic requirements are mentioned below:

i. Number and Type of Aircraft	01 (one) 777-200ER aircraft powered by PW4090 engine
ii. Nature & Period of Lease	Dry Lease for 60 (sixty) months.
iii. Configuration	Two class standard configuration not less than 319 seats. All seats shall have to be in good condition.
iv. Age of the Aircraft	The aircraft should not be more than 10 years of age as on closing date of RFP.
v. Authorization	If the Lessor is not owner of the aircraft, owner's authorization/mandate must be submitted prior to negotiation
vi. Commencement of Lease	July 2015

2. Detailed terms and conditions have been given in the RFP schedule. RFP notice and schedule may be viewed in Biman's web-site: www.biman-airlines.com .
3. The Offers/Proposals are to be submitted latest by 1000 hours LT (0400 hrs UTC) 15 March 2015 addressed to General Manager (Corporate Planning), Biman Bangladesh Airlines Ltd., Head Office, Balaka, Dhaka, Bangladesh through E-mail at dacpm153@bdbiman.com. Proposals/offers may also be submitted through courier service or dropped in the Tender Box placed in the office of General Manager (Corporate Planning), Biman Head Office, Balaka, Kurmitola, Dhaka-1229. No offer/proposal will be accepted after the closing time and date.
4. For further information or query, General Manager (Corporate Planning) may be contacted at Telephone: +880-2-8901600/Extension-2415, +880-2-8901697 (direct), Fax: +880-2-8901396, E-mail: gmp@bdbiman.com during the office hours.
5. Biman Bangladesh Airlines Ltd. reserves the right to accept or reject any or all the offers/proposals partly or wholly without assigning any reason whatsoever and no claim shall be entertained in this regard.

Mohd. Abdur Rahman Faruky
General Manager Corporate Planning (Acting)



Ref: DACPM/156/2015/1490

Date: 06 April 2015

Amendment to the RFP (Request for Proposal) for ACMI (WET) lease of two aircraft

Reference is drawn to the Request for Proposal (RFP) ref. DACPM/156/2015/1477 dated 25 March 2015 regarding ACMI lease of 02(two) aircraft for a period of three months. The RFP Notice and Schedule were posted in the official website of Biman (www.biman-airlines.com) on 25th March 2015. The same was also published in the daily Kalerkantha and the daily Star on 27th March 2015 and 28th March 2015 respectively. The RFP is hereby amended to read as follows:

Clause reference	Existing provision	Amended provision
Seat Configuration	Aircraft must have minimum 300 seats in two class	Aircraft must have minimum 250 seats in two class
Last date for submission of offer	Latest by 1000 hrs BST (0400 hours UTC) on 16 April 2015	Latest by 1000 hrs BST (0400 hours UTC) on 28 April 2015

All other terms and conditions of the RFP Schedule will remain unchanged.

Mohd. Abdur Rahman Faruky
General Manager Corporate Planning (Acting)

Getting careers off the ground

flightglobal.com/jobs

EMAIL recruitment.services@rbi.co.uk CALL +44 (20) 8652 4900 FAX +44 (20) 8652 4877



Flightglobal Jobs

AVIATION CONNECTED

RECRUITMENT

Senior General Manager, Airports – Astana, Kazakhstan



General Role Description:

The **Senior General Manager, Airports** will report to the Director, Ground Services and will manage all administrative and operational functions of airports including:

- All airport operations, own and subcontracted services
- IATA SGHA and SLAs
- Handling processes and customer services (pax, ramp, cargo)
- Staff development: recruit, train and mentor local talents
- Ability to plan and manage departmental annual budget
- Develop and supervise different projects

Personal Requirements:

- Tertiary Education (University degree) with a minimum of 10 years management experience and overall 20 years of airline/airports experience.
- Very good written and spoken English
- Strong leadership qualities and people skills
- Team player
- Must be hands-on
- Highly motivated self starter who can work in a culturally different environment
- Very good negotiation skills

Job Requirements:

The Job will require knowledge and experience in the following areas:

- Previous Experience in running the Ground Services Operations of an Airline or a Ground Services Handling Agent Operations
- IATA AHM, SGHA and SLAs. Aircraft handling and process management
- Experience in ISAGO / IOSA
- Financial experience in setting and managing budgets
- Knowledge of SMS
- EU Ops documentation and structure
- Experience in hub management is an advantage

Please send your CV to hr@recruitment@airastana.com

Aviation Resourcing Services



Maintenance Personnel
Production Personnel
Temporary and Permanent
Global Reach

expert solutions, adding value

flight@resourcegroup.co.uk
www.resourcegroup.co.uk/ars
+44 (0) 1638 672 880



UK's No.1 Technical
Recruitment Company

Contract and Permanent
Recruitment Specialists in:

- Design & Analysis
- Systems & Software
- Manufacturing & Production
- Maintenance, Repair & Overhaul

E: aerospace@morson.com
T: 0161 707 1516
www.morson.com



Hello Tomorrow



Emirates

Make the move that moves you forward

Join Emirates as a pilot to enjoy unparalleled professional stability and faster career progression. With a fleet of over 200 modern aircraft and more than 280 on order, we are one of the fastest growing and most profitable airlines in the world. To move up with us, apply today.

Where could you be tomorrow?

emirates.com/pilots

Tax-free salary ♦ Global network ♦ Generous benefits ♦ Comprehensive insurance

*An exceptional fleet deserves
equally exceptional pilots.*



Become a Captain or First Officer on the world's 5-star airline.

People are our point of pride. Be a part of a multicultural group of professionals with a fulfilling career and a dynamic lifestyle in up-and-coming Doha. We want you to fly in one of the youngest fleets in the world and take advantage of the Fast Track to Command Programme, which helps qualified First Officers become Captains in a shorter time-frame. Come join us and be part of the world's proudest airline family.



World's 5-star airline.
careers.qatarairways.com

Flight crew



Talk to us for the most exciting
Expat Pilot Jobs in INDIA

jobs@proctoraviation.com
www.proctoraviation.com
+91 22 6120 4400

Flight crew

RECRUITMENT FOR
THE AVIATION INDUSTRY



AVIATION SERVICES

Tel: +353 1 669 8224
Fax: +353 1 669 8201

Email: recruitment@sigmaaviationservices.com
www.sigmaaviationservices.com

Maintenance



Safe Hands
Aviation Recruitment

Call: +44 (0)1524 381 544
Email: info@safehand.aero
www.safehand.aero

you're in safe hands with us

Engineering



Worldwide specialist for
Aerospace Engineering, Certification &
Management Services
E: yourcv@gdcengineering.com
T: +49 (0) 8153 93130
W: www.gdcengineering.com

AEROPRO **APPLY NOW**

- FLIGHT DECK
- CABIN CREW
- HEAD OFFICE STAFF

www.aeroprofessional.com

Flight Crew Services



- Commercial & VIP Recruitment
- Management Recruitment
- Temporary & Permanent
- Payroll

flight@resourcegroup.co.uk
+44 (0) 1256 368 500
www.resourcegroup.co.uk/fcs

Engineering

Aviation Strongfield

Strongfield Specialist Aerospace Personnel

+44 (0)20 8799 8924 amedhurst@strongfieldtech.com
www.strongfield.com

Ready to depart
from your job?

Start with jobs.flightglobal.com
THE job site for the aviation
and aerospace industry.



Flightglobal Jobs

AVIATION CONNECTED
Your industry, your job site

Technical Recruitment Solutions



- Product & System Design
- Project Management
- Manufacturing & Supply Chain
- Engineering & Engineering Management

trs@resourcegroup.co.uk
+44 (0) 1905 368 576
www.resourcegroup.co.uk/trs

Aviation Resourcing Services



- Maintenance Personnel
- Production Personnel
- Temporary & Permanent
- Global Reach

flight@resourcegroup.co.uk
+44 (0) 1638 672 880
www.resourcegroup.co.uk/ars

Bishop Gmbh

The preferred company for Stress (Fatigue & DT), GFEM, Composites), Aeronautical Research. Business units: Contract staff, Workpackages, Innovation and New Concepts, Aeronautical Research. www.bishop-gmbh.com
Contact bishop.peter@bishop-gmbh.com
Tel 0049-(0)40-866-258-10 Fax 0049-(0)40-866-258-20

THE PERFECT PLACE TO FIND A NEW JOB

Our new mobile friendly job site makes it even easier for you to search and apply for jobs on the go from your mobile or tablet.

Search the latest aviation jobs today at jobs.flightglobal.com

APPLY FOR JOBS ON THE GO

#letsgetyoumoving

Flightglobal Jobs

jobs.flightglobal.com

WORK EXPERIENCE RITA FLAHERTY

A military approach to business

Rita Flaherty is vice-president of business development at Lockheed Martin Fire Control in Orlando, where she is committed to building strong, lasting relationships with the US armed forces, with which she once served

What led you into the military?

When I was 10 years old, one of my brothers entered West Point. I observed the great opportunities, challenges and fun he had, and I watched women cadets to see if I might be able to do what they were doing. I was inspired by their fearlessness and commitment and wanted to be like them. As graduation and commissioning neared at West Point, I selected Military Intelligence as my branch because I was intrigued by the strategic challenges of the role. After Intelligence, I served as an officer in the 2nd Armored Cavalry Regiment and in the 82nd Airborne Division, both located at Fort Bragg, North Carolina. I flew in helicopters and jumped out of [Lockheed Martin] C-130s and C-141s. The soldiers I interacted with were hard working, incredibly intelligent, up for a challenge and loved serving their country.

How did that prepare you for Lockheed Martin?

My time in the army showed me why companies like Lockheed Martin are so vital for the defence and security of our nation and allies. Our company motto is "We never forget who we're working for", which is the end-user – the soldiers, sailors, airmen and Marines who use our products and services.

Where else did you train?

After leaving the army in 1997, I attended graduate school at Syracuse University. While there, I held two separate internships, as well as paid work as a reporter at



Flaherty focuses on listening and understanding customers' needs

local TV stations. I enjoy writing, meeting people, asking questions, building relationships and telling meaningful stories. The work was fun and challenging, and allowed me to enhance a number of skills that I use in my current business development role at Lockheed Martin.

What roles have you held there?

Since joining Lockheed Martin in 2001, I've held various business development roles of increasing responsibility. I currently oversee a talented team that works closely with all branches of the US military and allied countries to ensure they have the fire control sensors

and systems necessary to complete their missions.

What's a typical day like?

My role looks a little different every day, but I regularly focus on listening and understanding our customers' needs and helping them find solutions for their challenges. I am also focused on being a good leader and helping my team meet their career goals. More than 80% of my staff has a military background, and we are all united in our commitment to do our best to support those who serve. Many of our customers come to Lockheed Martin because they want and need the

assurance that technology is achievable, reliable, on schedule and on budget. World events shape our customers' requirements every day, and we are honoured to help them address those challenges.

Is the glass ceiling as solid as it once was?

That's a question I was often asked and dreaded, when I was in the army. I feel incredibly fortunate to have had the women of the West Point classes of 1980 and 1981 as role models. Those were the first two West Point classes containing women, breaking 174 years of a male-only tradition. Because of their courage, confidence and conviction, my place at West Point was never credibly challenged. I've seen the defence industry continue to evolve, as evidenced by a growing number of female leaders, including our own chief executive. Lockheed Martin has been an exceptional employer for me personally. My top priority is to be a great wife and mother. Lockheed Martin has taken progressive steps to accommodate the "life" aspect of work/life balance, which helps me as I strive to have a fulfilling personal life and career. ■



Looking for a job in aerospace? Check out our listings online at flightglobal.com/jobs

If you would like to feature in Working Week, or you know someone who does, email your pitch to kate.sarsfield@flightglobal.com



Build your career

Try Flightglobal Training's new site for the fastest route to building your aerospace and aviation career



Flightglobal Training

Training courses to take you there
www.flightglobal.com/training

WELCOME TO THE INTELLICABIN® FAMILY.

Our wireless IFE system gives Vistara passengers the entertainment choices they want – from the latest movie releases, to the most popular games, to the newest TV shows and music – everyone on board will enjoy a truly transformative in-flight experience.

Learn more at: www.baesystems.com/intellicabin



IntelliCabin®
STATE OF THE SMART

BAE SYSTEMS
INSPIRED WORK